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Police Telegraph Service. THE importance of a good telegraph service in connection with the police force of a city cannot be overestimated, and it is encouraging to know that the public is alive to the desirability of giving police officers on their beats the ready command of all the facilities of his department and of placing each within ready call of headquarters. We illustrate on another page what has been done in Brooklyn, and venture to express the hope that ere long New York will have solved her own difficulties in this matter.

Balanced Dynamos. THE criticism raised by a contributor against some statements by Prof. S. P. Thompson regarding the balancing of moving parts is taken up in this issue by Prof. W. A. Anthony, who shows truly that the question can be decided in two ways, according to the nature of the forces involved. At the same time, Professor Anthony draws attention to a frequent cause of trouble in balancing the armatures of dynamos, especially those having considerable length. In such cases the counterweight, if not placed on the same diameter as the part out of balance, may introduce new inaccuracies and make balancing impossible.

Utilizing Wind Power. THE attention which Mr. A. R. Wolff has recently again drawn to the entire feasibility of operating storage battery plants by means of wind power has brought out a number of confirmatory experiences, which go to show the correctness of his views. Thus we print elsewhere the results announced by Prof. Blyth, who, with indifferent apparatus, obtained a good return. He cites an instance in which the wind was so steady that a half day's charging sufficed to store sufficient energy for several days' running. With these evidences rapidly multiplying, the day cannot be far distant when the windmill and storage battery will be looked upon as a valuable means of utilizing one of the "waste" powers in nature.

Electrically Driven Press Rooms. IT was early seen that the introduction of the practical electric motor would be an immense boon to printing offices and press rooms, and one is not surprised, therefore, to see a power so handy, clean and compact in form adopted by printers everywhere. When we printed some 80,000 copies of this paper by electric motor at the Philadelphia Electrical Exhibition in 1884, there was no other such plant in the country in regular operation. To-day there are literally hundreds of presses all over the country driven electrically, and the results are generally of the most satisfactory character. We illustrate such an installation in this issue, and it will be admitted that the successful handling of so many presses by a single little motor, stowed away in an obscure corner, is sufficient proof of what the new power can do.

An Electric Power Pioneer. IT would not be right to record the death of Mr. A. F. Upton without a recognition of his work as a pioneer in the department of electric power in this country. Though not an electrician, and though actively engaged in steam engineering, Mr. Upton was from the first a warm friend of the electric motor, and his advocacy was characterized by all the frank heartiness and directness of his nature. He not only argued in favor of the motor, but he was always ready to promote its interests, and at the time of his death was director in an electric railway company. His speeches before the National Electric Light Association in behalf of electric power were always weighty and forcible, and he lived to see the electric light companies all over the country adopting, as a prominent feature of their business, the sale of current for power, as he had always recommended. Pioneers of his stamp do much for the success of new and arduous undertakings, and their loss is keenly felt.

New York Electric Lighting Rules. THE Board of Electrical Control in this city is finding the ground firmer under its feet, and is now inclined to put its powers to decisive test. It would appear that the law governing its action is capable of broad interpretation. Hence we note its new provision, not only as to conductors but as to plant, which few people supposed to be included in the Board's supervision. It is some satisfaction to know that the Board has chosen as its electrical expert so thoroughly capable a man as Mr. Schuyler S. Wheeler. That selection alone would be evidence of the Board's determination to be guided by the best advice. Mr. Wheeler is second to no electrical engineer in this city for ability, energy and professional training, while the technical or scientific opportunities of the post are such as to stimulate in the work of making things go well and smoothly any one whose sympathies are so thoroughly with all electrical development as are his. In many respects Mr. Wheeler will fill an office of difficulty and anxiety, but we think it will be a relief to all engaged in supplying electrical service in New York to know that they will have to deal with an engineer of such competency and wide information.

What Shall We Read? WE sometimes hear of prizes being offered for the best list of works in popular literature. The offering of a similar prize for the best list of electrical works would occasion considerable difficulty of choice, depending very much upon the standpoint from which the judge views the question. It is in electricity as in all other technical branches, in that the application to one course of study would lead to a choice quite different from that which would be hit upon with another course of study or of work kept in mind, and thus while a few books might be called generally applicable, each department has its own special works. We have occasion so often to advise correspondents as to the best books to read on certain electrical subjects, that the article by Mr. T. D. Lockwood, begun in another column, will, we hope, meet the wants of a large number of students whose modesty may have prevented them from asking the same questions. It is likely that all will not agree with Mr. Lockwood in his selections, but all will feel that he has rendered a service in making a careful classification and in giving so many excellent reasons for his schedules. If any of our readers are bent on any line of study, they cannot do better, we think, than take the course that Mr. Lockwood proposes for them.

The Electric Boat "Magnet." ONE of the most interesting articles in our columns this week is that which illustrates and describes the Reckenzaun electric launch "Magnet." We had an opportunity of testing the boat last week in a run of 28 miles, from New York across the seaway to Staten Island, then around up to Newark Bay and by the Passaic to Newark. Altogether the boat made that day over 60 miles with the utmost ease, and the batteries still had at least a ten-mile charge in them. The boat throughout did her work splendidly, and, to us, the greatest charm of all about the trip was the absence of everything except a smooth, swift motion, as easy as a bird's flight and just as noiseless. We can imagine no greater pleasure for a lazy man who loves the sea than the possession of such a boat, which, started at eight in the morning by a touch of the finger, will run without further attendance till six at night, and then be as cool as an icehouse. It will be remembered that in just such a boat as this Mr. Anthony Reckenzaun captured a sleeping seabird when crossing the English Channel, and his brother could have done as much last Thursday had there been birds to catch. No noise, no dust, no heat, no smell, no labor, high speed—what more can one ask in a pleasure craft, or, for that matter, in a war launch?

Phonographic Reproduction. IT is not to be wondered at that, with the resources of modern science at command, a number of ways should be suggested by which the human voice shall be recorded and reproduced. In a late well-considered survey of he field, Prof. Houston has shown the various means which can be adopted to effect the desired purpose, and in which the chemical action of light in photography, mechanical devices, etc., play an important part. The electrical reproduction is especially looked upon with favor by the author on account of the ease with which the record can be made audible, so as to include the most minute components of the sound. It is not expected, however, that the best method may be the one generally adopted, as considerations other than those of absolute reproduction may enter into the problem. Thus while one may give exact reproductions with a somewhat complicated intermediate process, another may reproduce directly but not so perfectly. Hence while we may develop absolutely perfect methods for special purposes, the practical method must of necessity be confined to simple and direct means. Our columns have already contained descriptions of apparatus of this nature, and the electrical method, in connection with the microphone and telephone, seems specially adapted to the purpose, and presents a wide field for investigation and experiment.

Our Lights as Others See Them. AMERICANS have become so accustomed to books written about them by foreigners, especially Englishmen who come and stay among them for a short while, that the adverse criticisms, usually the result of hasty judgment, are now passed by with very little notice. It is refreshing, however, to note the impression which electrical America has made upon several recent visitors from abroad. Thus one of the foreigners who has just left our shores, after a thorough investigation of our methods of working, admitted frankly that it was part of an electrician's education to visit us, in order to become familiar with the great diversity and large number of applications which electricity has reached here. An English contemporary, again, contains the impressions of two others who have come from abroad, and have also put their time to good use among us. Some ideas which the latter have formed concerning us are also well founded, so far as they can be from such a limited sojourn among us. The criticisms, though few, are certainly fair, and not imbued with a spirit of captious fault-finding. Thus they remark, perhaps with justice, that the American ideas of measuring instruments in central stations are very crude, and from instances which have come under our personal observation we can substantiate this so far as central station work is concerned. Indeed, we know of one case in which an important installation is run entirely without indicating apparatus, and this by the order of superior authorities. That the station can be kept in satisfactory operation at all speaks well for the apparatus, but it is putting an unnecessary strain upon it, which may some day be regretted. After reviewing the great progress made here, our visitors come to the conclusion that Englishmen have nothing to learn in the States, but, on the other hand, that we have nothing to learn from abroad. The differences in practice are due more to differences in circumstances, and not to the foreigner being too scientific, or to our being guided by rule of thumb. Considering the latter point especially, our visitors are, perhaps, unnecessarily severe on some of their own countrymen, especially upon those who drag a lot of mathematical expressions into their work, and are regarded as authorities whether their mathematics are properly applied or not. They also allude to the difference in the nature of the discussions which take place before the scientific electrical societies here and abroad. They emphasize the fact that the English electrician never speaks, excepting to enlighten the world from a superior standpoint, and rarely asks a question which would expose his ignorance on a theoretical point; whereas, we, in true Yankee fashion, are not afraid to get up and ask for information on a point which is not clear to our minds. And finally, they discuss the question why America is so far ahead of Europe in electrical applications. They claim that the difference is caused by the fact that in Europe the country is developed and settled down, whereas in America it is wholly in a state of transition, and that innovations here are not likely to upset old institutions, for the reason that the latter do not exist; and they offer the assumption that the go-ahead qualities of the Americans are the result of circumstances, and not of differences in the cerebrum.

What Shall We Read?—Part I.

BY THOS. D. LOCKWOOD.

The above question does not mean, what shall the general public read, but what is the best mental pabulum for us who have to earn our bread and butter by dabbling in applied electricity.

It is not possible to give in a few words a categorical answer to such a question, although I think it would have been up to the year 1877.

The number of persons directly or indirectly connected with the applications of electricity in the United States alone must at the present time be well up in the thousands; while before the year which I have named, we could have approximately enumerated them by counting the telegraph offices, and then adding the electroplating and typing establishments.

But now the art of electrical illumination has grown to be a giant industry, with numerous departments: the transmission of power and the electric railway are monopolizing the attention of a host, and the telephone is by no means in the background as a means of furnishing employment for a considerable number of persons of both sexes.

Now, of the entire rank and file of both sexes earning their living by electrical pursuits, it does not seem unfair to assume that about one-third are desirous of improving their position by increasing their knowledge of the science they are utilizing, and especially of that department of the said science in which they are specially interested. None of us are so thoroughly informed that we do not require to know more, although it is possible that some of us think we are. But of the third which I have supposed, it is safe to say that at least two-thirds either have not the means to invest largely in books which treat of the subjects upon which they are employed, or have very little time to spare from their work in which they may study.

To these, it may be suggested that almost any one can buy one book at a time; and a good book may be read at intervals, a little at a time, and text-books of electricity will bear reading and re-reading over and over again quite a number of times; and, as a rule, the more they are read, the clearer they grow and the more valuable they become.

Of the remaining ninth, probably at least one-half have already a good knowledge of the literature of electricity, voluminous as it has grown to be, and this class is continually increasing as students graduate from technological institutions and similar organizations.

I desire in this article to impart information to those who wish to increase their knowledge as much as possible, but who by virtue of their circumstances and surroundings are obliged to be discriminative in their choice of books, and who want to know just what books will best meet their special case.

Firstly—It is right to say that an electrical library, no matter how complete, cannot take the place of the electrical newspaper. Every man engaged in applying electricity should make a point of taking that one of the weekly electrical periodicals which, after due inquiry among his associates, he decides to be the best adapted to his wants.

If he can afford more than one, he ought to take one English and one American periodical; or if his treasury be sufficiently plethoric, he will find it advantageous to subscribe for all of the American weekly and monthly electrical periodicals, and also for the British *Electrical Review*, *Electrician*, or *Electrical Engineer*. Unless he be a linguist it would not be advisable to take a technical paper printed in a foreign language, because the main portion of the electrical news of the day is to be found in all of the journals printed in the English language; while any subject of general interest will likewise be certain to be found in at least one of them.

I have considered it expedient to speak first of electrical journals, because this is a generation that necessarily, to hold its own, must act in the living present; and though a man working now in electricity were thoroughly versed in the archæology and antiquities of the science, and though to this knowledge he add an extensive acquaintance with college text-books, this all amounts to very little if he fail to keep himself fully informed of the progress of the day; for history in electricity is now a matter of days, and is more rapidly made than ever before; the only way therefore to hold one's own is to peruse and study the journals.

But in addition to these, if we desire to have full information, in short, if we desire to excel, we require something more. It is true that the number of books is legion, but I imagine that half a dozen of well-chosen books will be all that a young man needs at the outset, and they will form a good nucleus round which a library may be built by slow but solid accretions.

I fear that I should try in vain if I were to attempt to fit every case in suggesting books to be read, and that I should please nobody—not even the editor or myself.

I have, therefore, after a number of unsuccessful attempts to please the latter gentleman, whom I find to be one of the most critical and fault-finding of my audience, determined to imagine a number of classes of readers, to each of which a certain number of selected books may be suggested.

I assume that a library, or a nucleus of a library, of a dozen good books, may in each case be a fair starter; and it is surprising what an amount of information may be culled from a dozen well selected text-books.

Class A is intended for those who are starting out with the intention of succeeding in the profession of electrical engineering, but who have had no special education to that end, and who moreover have no money to spare.

CLASS A.

1. *Elementary Lessons in Electricity and Magnetism.* S. P. Thompson.
2. *Elementary Treatise on Electric Batteries.* Niaudet. Translated by Fishback.
3. *Electricity — Theory — Sources and Applications.* Sprague.
4. *Domestic Electricity.* Hospitalier.
5. *Electricity and the Electric Telegraph.* 2 vols. Prescott.
6. *Electricity and Magnetism.* Jenkin.
7. *The Bell Telephone, etc.* Prescott.
8. *Practical Electric Lighting.* Bromley Holmes.
9. *Dynamo-Electric Machinery.* S. P. Thompson.
10. *The Art of Electro-Metallurgy.* Gore.
11. *Physical Treatise on Electricity and Magnetism.* 2 vols. Gordon.
12. *Modern Applications of Electricity.* 2 vols. Hospitalier.

The above list comprises a useful yet compact vademecum of electrical application—and if carefully read and unwearyingly studied, will be found profitable.

I should also suggest that they be read in the order they have been set down, as by following that order they will not be found wearisome. It is not by this meant that until each one is read the others should not be used: they may all be profitably used as *tools* throughout; but simply that in addition to using them as tools they should be closely *read*, one after another; and it will also be a good thing to read them over a second and even a third time; the reader will be astonished to note his keener appreciation, and to find the new beauties in electricity which each reading will disclose. By looking over the bill of fare thus presented it will be seen that the first, third, sixth and eleventh books of the series are works upon the general subject; that the second presents the very interesting features of voltaic batteries, with which the student cannot too early acquaint himself; that the ninth discloses the use of machine currents, and tells how and why under many circumstances the dynamo and magneto electric machine can and should be substituted for the battery as a source of electricity; that the fourth and twelfth present in an entertaining but practical way the numerous uses which electricity is applied to; the fourth being a most fascinating book relating to the utilization in the home, and the easy and profitable study of the subject, by making the subtle force minister to the daily wants of life; while the fifth, seventh, eighth and tenth each deal both pleasantly and practically with some one of the principal applications of electricity. But, says some one, those books cost a good deal of money, and it takes all I can earn to support myself and family. My dear sir, if you will regard your books as tools which you must have, or as so much money invested which is by and by to bring you back a handsome return, you will be wise; besides, there is no special need of buying them all at once; buy them one at a time if you can't do it any other way. Books of the class enumerated will also be on sale, either in one edition or another, only if you buy them in the lot you can usually get something of a discount.

Proceeding to the next class—B—this is intended for telegraph operators wishing to know something more than their daily work can teach them, and to fit themselves for better work.

In this case I should advise letting the general study of electricity go easy for awhile, and beginning with telegraphy itself.

CLASS B.

1. *Manual of Telegraphy.* Smith.
2. *Hand-Book of the Electro-Magnetic Telegraph.* Loring.
3. *Modern Practice of the Electric Telegraph.* Pope.
4. No. 1 of Library A. Thompson's *Electricity and Magnetism.*
5. *Outline of Railroad and Commercial Telegraphy.* Abernethy.
6. No. 5 of class A. Prescott's *Electricity.*
7. *Electricity, Magnetism and the Electric Telegraph.* Lockwood.
8. *The Quadruplex.* Maver and Davis.
9. *Telegraphy.* Preece and Sivewright.
10. *Hand-Book of Practical Telegraphy.* Culley.
11. *The Galvanometer.* Haskins.

or

11. *Electrical Measurement.* Lockwood.
12. No. 3 from class A. Sprague's *Electricity.*

A telegrapher who has in him the elements of progress will find an ample supply of mental food to satisfy his longings in the above list. He will by examination and study of his instruments and their operation gain a sufficient degree of experimental knowledge to inspire with a thirst like that of the late Oliver Twist for "*More.*" The three first which are suggested are low priced, and the matter they contain is easily digested. They should be studied in the order given, and the information they impart is of such a character that it can never grow old, and must always be valuable as long as Morse telegraphy holds its own. These books will enable the student to know *why* he does such and such things, and if he is the right kind of a man will brace him up for those that follow. After he has read the third, it will be high time for him to know a little more of the nature and other functions of electricity, and he will do well therefore to read Thompson's *Lessons*, No. 4. Then No. 5 will serve as a recapitulation or review of the knowledge he has accumulated; No. 6 will require close study, and will introduce him not only to Morse telegraphy, but also to the numerous other systems which are to a greater or less extent practiced; No. 7 covers considerable ground in a familiar and easy style, and being in the form of questions and answers, may assist him in answering some of the questions, which his mind will persistently and automatically evolve; No. 8 elucidates one of the most attractive and utilitarian problems of telegraphy, and is invaluable; while Nos. 9 and 10 will give a correct idea of the electric telegraph from an English point of sight, the latter volume being particularly clear when dealing with the subjects of induction and cable testing. By this time the idea of electrical measurement will have become interesting, and a study of No. 11 will be found to pay for itself, the library finishing up with Mr. Sprague's work on *Electricity;* perhaps the finest general work on electricity, practically considered, which is now on sale.

Library for class C, including those desiring to study electricity and magnetism chiefly from a historical or archæological point of view, comes next.

Before giving a list of books on this subject, it is suggested that the articles on "electricity" in the last three editions of the *Encyclopedia Britannica* are perfect mines of wealth.

CLASS C.

No. 1. *Annals of Electricity.* Sturgeon.
No. 2. *History of Electricity.* Priestley.
No. 3. *History of Telegraphy up to* 1837. Fahie.
No. 4. *Telegraph in America.* Reid.
No. 5. *Age of Electricity.* Benjamin.
No. 6. *Students' Manual of Electricity.* Noad.
No. 7. *Abridgement of English Electrical Patents.*
No. 8. *History and Progress of the Electric Telegraph.* Sabine.
No. 9. *The Electric Motor and its Applications.* Martin and Wetzler.
No. 10. *The Electric Light—Its History, Production and Application.* Alglave and Boulard.
No. 11. *The Telegraph Manual.* Shaffner.
No. 12. *Lives of the Electricians.* Jeans.

These books will open for settlement some promising fields of investigation. Some of them, notably the first two and the eleventh, are hard to get, but most of them are in stock. I have myself found much pleasure in reading them, and have been surprised to note the amount of information about the old days of electrical science contained in them, and I have found Mr. Fahie's book on the early telegraphs particularly interesting.

Atmospheric Electricity.

Prof. L. Weber describes in the *Elektrotechnische Zeitschrift* a very interesting series of experiments on atmospheric electricity. He erected two *insulated* conductors on the top of the Riesengebirge, but he says that, curiously enough, since these have been put up they have never been struck by lightning, although before their erection lightning flashes were continually occurring. He also made some kite and balloon experiments, in connection with which he goes, at considerable length, into the question of the effect of the conducting string in altering the electrical condition of the circumjacent air-layers, and also considers the effects due to a long conductor completely insulated from earth, and without discharging points; a similar conductor, with slight power of discharge along its whole length; an insulated conductor, with strong discharging power (*e. g.*, a flame) at the upper end, and other similar and more complicated cases. His kite-string was really a steel wire; the discharging points on the kite consisted of 400 needle-points. In other cases he had the tails of the kite made of silver-paper for the same purpose. The potential was measured by the length of the sparks, and the current with a galvanometer; the latter varied in general from .07 to 2.5 microampères. The potential varied generally from 3,000 to 10,000 volts. When thick clouds were overhead there were no appreciable sparks, the strongest sparks being obtained when the zenith was either quite clear or when cumulo-stratus clouds appeared. With potentials of 11,000 and 20,000 volts, currents of 4 and 8 microampères were obtained. The original paper will well repay perusal by those interested in the subject.

Johns Hopkins University.—Certificates of proficiency in applied electricity have been awarded to Cary Talcott Hutchinson, Ph. B., Washington University, 1886, of Missouri; Joseph Lee Jayne, United States Naval Academy, 1882, Ensign United States Navy; Henry Hazlehurst Wiegand, A. B., Johns Hopkins University, 1885, of Baltimore; Gilbert Wilkes, United States Naval Academy, 1881, Ensign United States Navy.

Wind Power for Electric Lighting.

An interesting paper dealing with the production of electricity by wind power was read by Prof. Blyth before the Glasgow Philosophical Society recently.

During last summer Prof. Blyth had an opportunity of making a practical experiment. He erected a small windmill for supplying electric light by means of storage cells to a small cottage in the village of Marykirk, where he spent his summer holiday. The windmill was of old English type, and was erected in the garden.

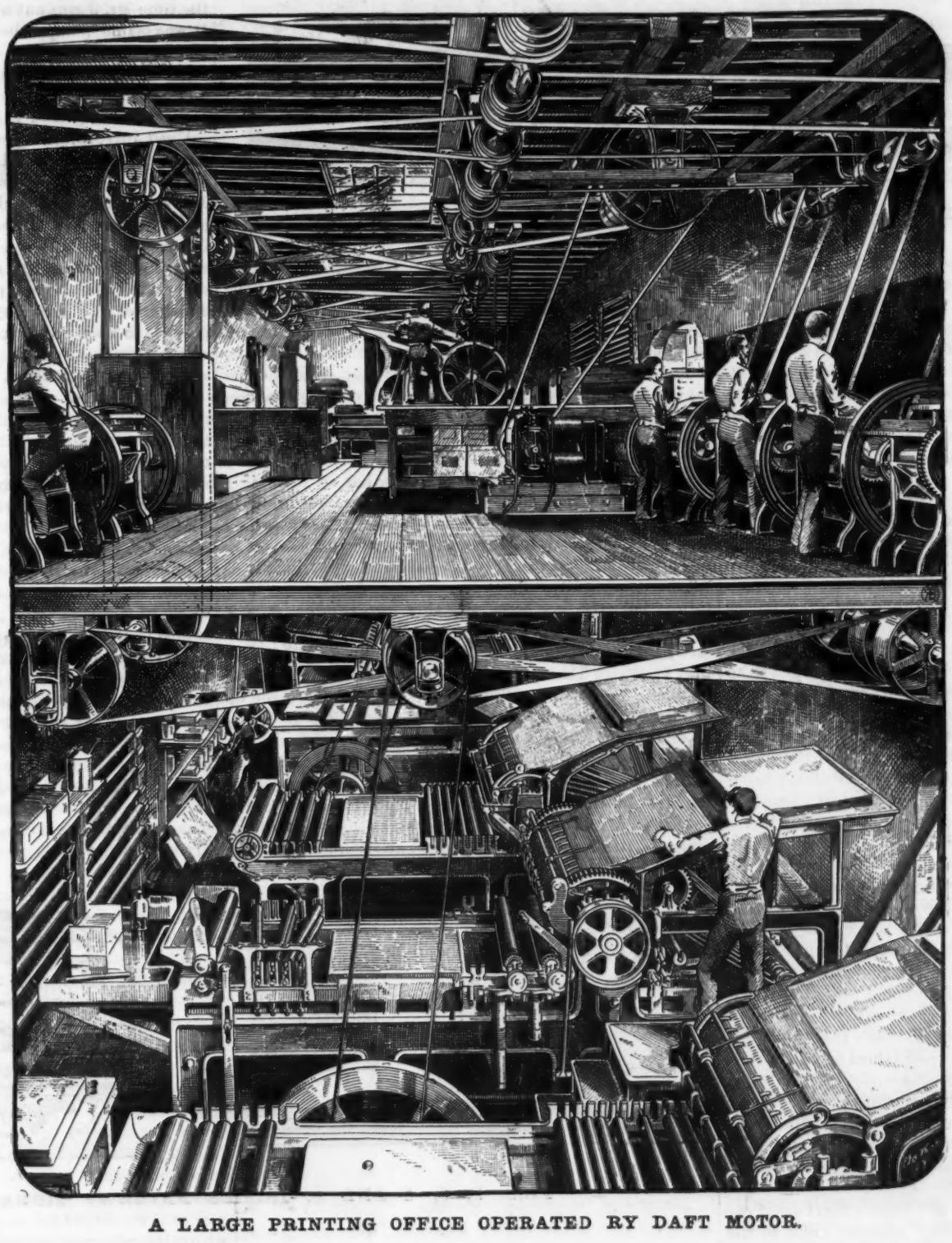
The tower consisted of a wooden tripod firmly fixed in the ground, and strongly braced together by bars of wood. The wind-shaft stood about thirty-three feet above the ground, and carried four sail arms at right angles to each other, each being thirteen feet long. The dynamo, an old form of Bürgin, was driven directly from the fly-wheel by means of a rope, and a workable speed was attained even when the windmill moved at a comparatively slow speed. The current from the dynamo was employed to charge 12 Electric Power Storage cells, which supplied the incandescent lamps in the cottage.

As yet he had only used at one time ten eight-candle power 25-volt lamps, but he found that storage for more could be quite easily obtained. One day when a good breeze was blowing he stored as much in half a day as gave light for four evenings of about three or four hours each. As yet, however, he had not had time or opportunity to test fully the capabilities of his arrangement. For one thing, he required a more suitable dynamo and a much greater storage capacity, so as to take advantage of all the wind blowing, and when this was done he had no doubt whatever regarding the complete success of his experiment.

While charging, the current passed through a cut-out arrangement, which immediately disconnected the cell from the charging circuit when the dynamo ran below a certain speed. In this way the windmill could be allowed to run day and night, as it would only store when a certain speed was attained, and the cells were effectually prevented from discharging themselves through the dynamo even should it stop.

On several occasions he had used the stored electricity to drive a small turning lathe, and he had begun to make a light form of carriage to be driven by the same. In conclusion, the Professor jocularly remarked that he preferred wind power to water, because the latter was usually tied up. The landlords, however, had not yet claimed a right over the wind, although a place that had a good draught might have a money value.

A Daft Electric Motor in a Printing Office.



A LARGE PRINTING OFFICE OPERATED BY DAFT MOTOR.

One of the most notable advantages connected with the use of electric motors is the small space they occupy compared with the power developed, and visual proof of this is afforded by the accompanying engraving taken from actual photographs of a Daft electric motor of 15 h. p. and its train of driven machines, in regular operation on the East-side circuit of the Electric Power Company (Daft system), of New York City.

The locality of the scene depicted is No. 20 Cliff street, and its central feature is the 15 h. p. Daft electric motor, of which Messrs. J. B. Stillwell & Co., printers, are lessees.

In justice to the motor it should be said that the illustration does not by any means represent all the work done by it. Besides the omissions unavoidable in showing two floors in a perspective common to both, and which, in the present case, obscures almost all the shafting in the lower story, there is still a lowest story and a room adjacent to the upper one, both containing machinery driven by the motor, but in which the absence of proper light forbade any hope of successful photography.

To afford a just appreciation of what load the motor is actually carrying, the following list is introduced. On the upper floor, and in the room alongside to which reference has been made, the Messrs. Stillwell run:

4 Cylinder presses, Bedplate, 33 × 51 in.
3 Cylinder presses, Bedplate, 33 × 46 "
2 " " " 26 × 33 "
1 Cutting machine, 33 in. knife. 22 × 23 in.
1 Hoist, average load, 900 lbs.

On the floor next beneath, Messrs. Heffron & Phelps, lithographers, run:

1 Potter press, No. 3, Bedplate, 30 × 46 in.
1 " " " 2, " 24 × 34 "
2 French " " 26 × 36 "

And on the lowest floor, not represented in the view, the New York Elbow Company are driving the following machine tools: 2 shouldering and burring machines, 1 crimper, 1 former, 1 drop mold.

It would clearly exhibit the striking contrast between the cubic spaces relatively occupied by this motor and a steam-engine, even without its boiler, competent for the same work, if they could be represented side by side; but there is no opportunity of doing this at present.

The comparison is flattering enough for the motor without regard to boilers, and although the nuisances of supplying coal, removing ashes, cost and noise of stoking and pumping, dust, gas, heat, and fire-risk are consequently eliminated, there is still to be considered, beside the simple space occupied by the engine proper, attendance, noise, heat radiated from cylinder and pipes, and the spatter and odor of oil.

The motor spares its patron each and all of these, and this least favorable comparison leaves a margin of advantage with it which can only disingenuously be ignored or questioned.

The working potential for this machine should be 125 volts, and, since the resistance of the armature is only .033 ohm, it is evident that the current—about 100 ampères—required to develop the full rated power, namely, 15 h. p., will be circulated through the armature with a difference of potential amounting to only 2.6 volts. It is, therefore, evident that the variation of speed between no load and full load cannot exceed 2.6 per cent., while for the ordinary range of work it will scarcely be appreciable.

Striking as this exhibition is, *per se*, it becomes even more so when considered as only a component of a large circuit which reaches in one direction from New Chambers to Beaver street, and in another from the East River to Broadway, distributing power in amounts ranging from 1 to 15 h. p., among some ninety consumers, whose belief in, and satisfaction with, the system is demonstrated by their adherence to it.

While in the brief period of its practical application it has overcome nearly, if not quite, all the deficiencies and inaptitudes which nothing but use reveals in new mechanical systems, there is no reason to imagine that it has reached its ultimate, or that there is not still a career of development before it whose *finale* is not easy to conceive, but which "he who lives will see." One feather in its cap is that during the "blizzard" of last March it continued to work without an instant's delay or interruption of any kind, which, it is safe to declare, could not be said of many other electrical circuits in the region.

The Conductivity of a Vacuum.

M. Foeppl, in *Wiedemann's Annalen*, gives the results of some experiments *apropos* of this vexed question. M. Edlund, in maintaining his theory, claims to have recognized phenomena of a luminous character, even when the vacuum has become so perfect as to prevent a visible discharge between the electrodes. M. Foeppl has studied the currents of a secondary closed circuit, actuated by an induction coil. This first was formed on a glass tube 7 millimetres outer and 4.2 millimetres internal diameter, and was composed of two layers of 18 turns, having an outer diameter of 67 millimetres. The electrodes of this glass coil were connected to the two ends of a second coil, also on glass, so arranged as to form a galvanometer, within which was placed a circular mirror magnet, suspended by a fibre of cocoon silk. The primary coil was 24 centimetres in length, 7.1 centimetres inner and 15.3 centimetres outer diameter, and was composed of 12 layers of 72 turns of copper wire 22 centimetres diameter, without the insulation. With this apparatus, and a current of 22.5 amperes, M. Foeppl could not discern the least movement of the needle, either on closing or opening the circuit. Neither could he discover the least phosphorescent light in the glass coil, with large range of rarefaction. The specific resistance of a vacuum, as shown by mathematical calculation, is at least 48,000 times that of mercury, or about 3,000,000 times that of pure copper.

A New Arc Lamp.

In a communication to the Académie des Sciences of Paris M. C. Pollak describes a form of arc lamp in which the regulation is effected by the expansion through heating of wires. The current passes to the carbons through a brass wire, sufficiently thin to be sensibly heated by the passage of the current, and which is kept stretched by a helical spring, also of brass, and the other end of these springs is connected by a magnifying lever with the carbon-holders. Before turning on the current the carbons are in contact, but on closing the circuit, the current passing through the wires mentioned above causes them to stretch, separating the carbons. When the arc is formed, its resistance limits the current passing through the apparatus, and with it the elongation of the wires, and a steady light is obtained. As the carbons waste away the increased resistance diminishes the expansion of the wires, and allows the two carbons to approach each other. It is claimed that with this apparatus the light can be maintained for three hours without attention, and the relighting in case of extinction is automatic, but the intensity of the light increases slightly during work. The apparatus is stated to work well, giving little trouble, owing to its great simplicity, as neither gearing nor electro-magnets are employed, the whole regulator being made from a block of wood and four brass wires.

National Car-Builders.—The Committee on Freight Train Brakes of the National Car-Builders' Convention, at Alexandria Bay, reported that the air brake was being brought to perfection for that class of cars, and did not need the aid of electricity.

Irish's Railroad Block and Intercommunicating System.

With the object of reducing the danger of railroad travel and of establishing continuous communication between different trains, as well as between the trains and the dispatcher, Mr. W. E. Irish, of the Globe Electric Company, of Cleveland, O., has designed a system in which is employed a flexible conduit, already described by us in connection with his electric railway system.

Mr. Irish's railroad signaling system simply consists in connecting trains electrically whenever two arrive upon the same section in such manner as to close the battery circuits through each other's apparatus, sounding each other's alarms and deflecting each other's indicators to the cause. As a means to obtain this result there is laid in the centre between the ordinary traveling rails throughout the whole railroad system a one-inch rubber tube containing two sectional conductors, which are insulated from each other and sealed to the bottom of the tube, the upper surface of the conductors being left bare and exposed within the tube. These sectional conductors break joints and have an insulating space situated about the centre of each other. This is shown in Figs. 1, 2 and 3, which represents the conduits in longitudinal and transverse sections and in plan respectively. Within the tube and above and normally out of contact with these long sectional conductors shorter sectional metallic contact pieces are supported by the walls of the flexible rubber tube through and to which they are bolted from the outside. The bolts rigidly hold the surface and expose short sectional contact rails together.

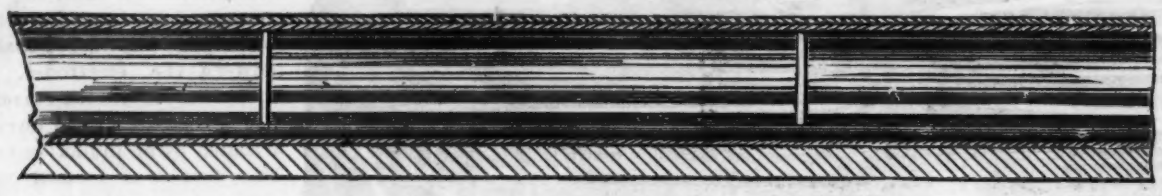


FIG. 1.—IRISH'S RAILWAY SIGNAL SYSTEM.

The rubber tube, fitted, as above described, is placed in a wood trough which is secured to the ties along the centre of the track. The short sectional surface rails between the ordinary traveling rails are left almost flush with the surface of the road-bed, as shown in Fig. 4. Two such conduits are placed parallel to each other, and a few inches apart in the same timbers. Each engine carries battery, alarm, indicating apparatus, and two contact wheels, the latter being fixed under the engine and so arranged as to run on and depress their respective short sectional surface rails until the corresponding contact-piece within the tube makes contact with the long sectional conductor. One contact wheel is connected to the positive and the other wheel to the negative pole of the battery, the alarm being connected to the centre of the battery and then grounded.

All trains being connected alike it follows that when a down train enters a section in which there is already an up train, the current from both the batteries will be closed in the same direction through the alarms and indicating apparatus shown in Fig. 5, sounding the former and causing the needles or pointers of the latter to be directed to the wording on the dials which signifies the cause of the alarm. For instance the pointers on the "up" train, or train, say, going north, may be directed to "stop down train" and on the "down" train or one say going south to "stop up train." As the engines advance they carry forward the contact wheels on to fresh short sectional rails which are depressed in turn by the wheels, while those passed over are carried by the elasticity of the rubber back again to their normal and insulated position. A combined brush and scraper travels in advance of each of the contact wheels and clears the surface sectional rails from all obstructions.

The alarm at a road crossing is connected to two of the long sectional conductors through separate coils on the same electro magnet, the other ends of the coils being grounded. A train from either direction arriving within the same section at a crossing will cause the alarm at the crossing to sound and call attention to the approaching train; at the same time the gate at the crossing may be released and gradually close. The train on passing the crossing is caused to operate a simple mechanism which allows the gates to return to their original position The alarm at the crossing ceases to ring when the train has passed out of the section.

Should two trains come on the one section at a crossing at the same time, the alarms of both the trains will be sounded as well as the alarm at the crossing. At the same time the pointers on both the trains will be deflected and indicate the fact. If three or more trains were traveling on the same track and in the same direction, and supposing that the first is feeling its way through a thick fog, the second train would, on entering the same section, cause the alarms to be sounded on both trains and the pointers to indicate the cause. The second train would immediately stop on learning the cause of the alarm and allow the first train to advance out of the section, when the alarms will cease to sound and the pointers will return to the position indicating "all clear." Thus any number of trains can feel their way by keeping touch occasionally with the train in advance of it.

Besides this intercommunication between individual trains, the system also permits of their control by the train dispatcher. Thus the latter, in order to start a train, simply opens, by means of a switch, the circuit between his apparatus and that on the engine of the train to be started, when the pointers on the engine will fall back to zero, or "all clear." At the same time both dispatcher and engine driver are assured that their apparatus is in working order.

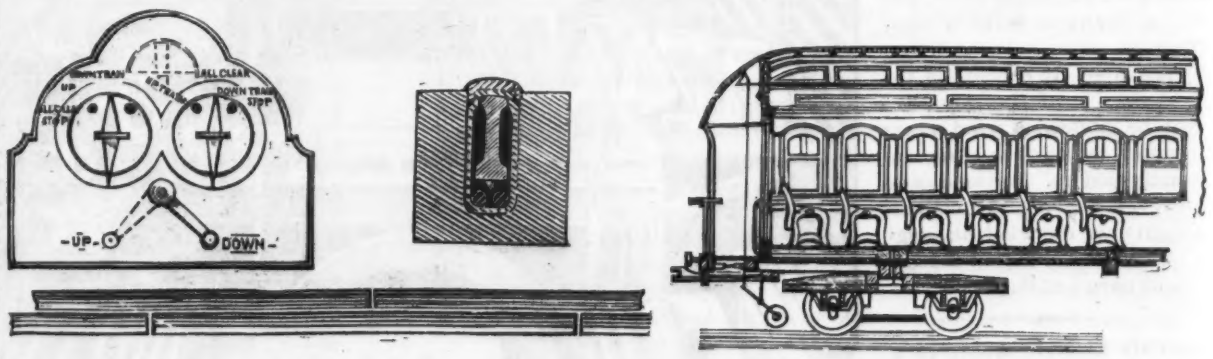
Finally, the system also permits of easy communication between the engine driver and the passengers in case of accident.

Balancing a Rotating Body.

To the Editor of The Electrical World:

SIR: In you issue of June 16 I find a letter from Mr. Charles Seymour in regard to a rotating body, in which a quotation is made from Prof. Silvanus P. Thompson, to which the writer takes exception. If seems to me that both Prof. Thompson and the writer are wrong in this matter, if I understand them both. Prof. Thompson is right and the writer is wrong in regard to the moment of inertia of bodies at different distances from the axis; the moments of inertia of the same body at different distances from the axis are as the squares of the distances, but both Prof. Thompson and the writer are wrong in supposing that the moment of inertia of a body has anything to do with the balance of the body, either statically or dynamically, except when the body has an increasing or diminishing velocity. If the body be rotating with uniform velocity, the moment of inertia has nothing whatever to do with its balance. The writer is correct in saying that a rotating body balanced dynamically is balanced statically, always supposing the motion uniform; but the converse of this proposition is not necessarily true; a body balanced statically is not necessarily balanced dynamically, but it is not for the reason that Professor Thompson states, but for an entirely different one. To illustrate: Suppose a long cylinder made up of thin discs; suppose that one of the end discs is heavy on one side of the axis and all the others are exactly balanced: if this cylinder be placed upon straight edges, it will, of course, appear out of balance in consequence of the error in that one disc; there is nothing, however, in the action of the cylinder on the straight edges to indicate which of the discs is out of balance, and suppose that the workman, in order to balance it, places a counter weight at the opposite end of the cylinder from the disc that is the cause of the trouble. Then, when the cylinder is made to rotate, it will appear more out of balance than before. In other words, to obtain a perfect running balance, the cylinder should be in exact equilibrium in every plane perpendicular to the axis. And this is a most important point to be considered in the balancing of the armatures of dynamos. I saw not long ago an attempt made to balance a dynamo armature by putting a counter weight in the pulley at the end of the armature shaft. The effect was to make the jar due to the running of the machine greater than before, very much to the surprise of the workman who balanced it. The cause of the want of balance may have been at the further end of the armature from the pulley. I have been led to write you in regard to this matter because I have found in actual practice that very few men understand the necessity of determining where a balance weight should be applied in order to give a correct running balance. In balancing pulleys that are usually very short in comparison with their diameters, a good result generally follows from placing the counter weight anywhere opposite the heavy side, as indicated by balancing the pulley on straight edges. But in balancing a cylinder like the armature of a dynamo the problem becomes a great deal more difficult one, and it is necessary to determine not only on which side of the axis the counter weight must be placed, but in what part of the length of the armature.

MANCHESTER, Conn. WM. A. ANTHONY.



FIGS. 2, 3, 4 AND 5.--IRISH'S RAILWAY SIGNAL SYSTEM.

Improvement in the Quadruplex.

To the Editor of The Electrical World:

SIR: Referring to Mr. Maver's articles on the quadruplex "in actual practice," namely, the Edison-Nicholson quadruplex system, in your May 19 and following numbers, and also to Mr. Jones' criticisms of the same in the issue of June 9, I think it but simple justice to the parties involved in the controversy to say that I was in charge of the multiplex apparatus as assistant chief operator of the Western Union Telegraph Company in the Chicago office from 1873 to 1880, and had daily care of the quadruplex from the time Mr. Jones put up the first set in December, 1874. It was on the plan of the Wheatstone bridge, as correctly described by Mr. Jones, and during the year 1875 many other sets were put up on the same plan between Chicago and the various surrounding cities. Many of these sets I personally assisted in wiring.

Until July, 1875, we could not work satisfactorily on the four sides of any ground out of Chicago, except the short Milwaukee circuit of 80 miles. About this time Mr. Jones put in operation the differential system (as per his patent of May 29, 1877) between Chicago and Detroit and Detroit and Buffalo, and the reports of the managers and superintendents were so favorable that the system quickly superseded the bridge plan everywhere on the central division of the company. At no time did I ever find it possible to dispense with the condenser between the main and artificial circuits. It was of vital importance in working the No. 2 relay.

The compound relay shown in Mr. Maver's Fig. 4 was introduced sometime in 1877, and worked somewhat better than the neutral relays introduced by Mr. Jones. I think the superior manner in which the compound relays were made contributed largely to this result, as Mr. Jones had to contend with some relays of very faulty construction. The condenser between the main and artificial circuits was also necessary to the use of this relay, for the reason that if a reversal of current took place during the time the tongue was traveling from the centre to one side the interval of no magnetism prevailed to allow the tongue to return to the centre and mutilate the signals. The plan Dr. Nicholson tried between Cincinnati and Chicago in 1875 or 1876 did not have a system of currents like those of Edison, and, from my personal observation at the time, both the key system and the relay system of Nicholson, as he described them to me, and as they were put up, were impracticable on a line wire.

During Mr. Jones' management of the Chicago office I can vouch for his indefatigable labor day and night to make the Edison quadruplex an efficient system, and with my knowledge of his achievements it seems to me hardly fair that an *attaché* of the electrician's office of the Western Union Company in New York should be so unjust as to link with Edison's the name of a person who never contributed the slightest idea to the system Mr. Maver undertakes to describe.

CHICAGO, Ill. HENRY W. PLUM.

Ocean Telegraphy with Morse Key.

To the Editor of The Electrical World:

SIR: I notice with great pleasure in the issue of your valuable journal of the 9th inst. that an old friend, Mr. P. B. Delany, has in earnest taken up the subject of doing "Morse" on long "ocean cables," a subject inaugurated by me in 1872. A very full illustrated description in what way to more rapidly operate ocean cables and to transmit Morse writing by the Morse key or automatically between New York and London appears in my patent bearing date April 22, 1872 (London No. 1,207).

I heartily wish Mr. Delany every success in getting such an important matter brought without delay into public use, and thereby to more greatly benefit mankind.

PASSAIC, N. J. GEORGE LITTLE.

The Police Telegraph Department in Brooklyn.

The importance of supplementing a police force by an efficient means of communication is now generally recognized. At one time, and not so long ago, all that was supposed to be necessary was a large force well distributed; but rough and severe experience has shown that for much of its work a police department is little better than wasted, unless it has as one of its arms and aids a trustworthy, well-managed telegraph bureau, by whose intervention the officers throughout the largest city may co-operate and act as one body, not only in catching evil-doers but in the prevention of crimes and accidents of whatever nature. The moral support given by the telegraph, too, is almost as great as the physicial. The officer on his beat is the stronger for knowing that at any minute the scene of danger in which he is an actor may be made the focus toward which help from all quarters will be directed; while

FIG. 1.—BROOKLYN POLICE PATROL WAGON.

the concsiousness that the police telegraph enmeshes him all around, like a big net, often deters the criminal from attempting a coup that would be easy under ordinary conditions. It has frequ ntly been said that every electric light on the street is equal to a policeman, and in the same way the police telegraph duplicates a whole force in a highly economical manner.

The telegraph bureau of the Brooklyn Police Department is one of the most important and best equipped establishments of its kind in the world. It is connected by dial telegraph and telephone wires with every station-house and hospital in the city, as well as with the ambulance service, fire department, department of city works and the department of health. It also has two wires to the central telephone office. The switch-board at headquarters will accommodate 100 wires. It was manufactured by Messrs. Chas. Williams, of Boston, and Pearce & Jones, of New York, and has all of the latest improvements. A general alarm sent out from headquarters is received at the various precincts (20 in number) within five minutes after it has left the superintendent's office, and the police thoughout the city are prepared to carry out its instructions. It is an ancient saying among New Yorkers that Brooklyn is a big village and a one-horse town. There is however, a branch of police work in which it is claimed Brooklyn is far ahead of New York, and that is the transmission of messages to and from police headquarters. While New York is struggling with the old-fashioned and slow-going dial system, Brooklyn is sending five and even ten messages to one by its thorough and absolutely complete telephone system. In 1885, 207,530 messages were sent and received at headquarters. There are six regular operators employed, besides the superintendent, Mr. Frank C. Mason, and four linemen. The operating sextet perform regular turns of duty. During 1886, 209,141 messages were sent and received ; and 208,320 during 1887. By virtue of the provisions of chapter 246 of Session Laws, passed April 30, 1887, the telegraph superintendent, operators and linemen were made members of the police force, and, although not liable to the performance of patrol duty, they are subject to all the rules of that department and possess all the rights and privileges enjoyed by members of the force. Vacancies in the Telegraph Bureau are now to be filled from the ranks of the force.

In 1885 $5,000 was appropriated for the establishment of the patrol system in the First Precinct. The Gamewell patrol system was adopted and completed in July, 1886, with 16 signal stations. Twenty thousand dollars was raised for the same purpose in 1886, and contract was made with Pearce & Jones to furnish their system to the department, the mechanical arrangements, telephone, etc., to be inclosed in an iron or steel box that could be attached to a telegraph pole or wall similarly to a fire-alarm box. On October 1 the Fourth Precinct was completed, with 25 street boxes; on November 1 the Fourteenth, with 22 boxes; December 1 the Sixth, with 18 boxes; January 1 the Tenth, with 20; and June 10, 1888, the Seventh, with 20. Both systems have given the utmost satisfaction and the number of boxes throughout the city will be largely increased during 1888 and 1889. Patrolmen on post are expected to report every hour. During 1887 the patrolmen of the First Precinct made 110,330 hourly reports, and the patrol wagon responded to 2,040 calls for prisons; ambulance calls, 97; fires reported, 22. At the present time the department has 170 sets of telephones, 25 sets of dial instruments, 225 cells gravity battery, and 250 cells Leclanché battery.

A representative of THE ELECTRICAL WORLD had the pleasure of inspecting the working of the patrol and telegraph systems a few days ago in company with Superintendent Mason, who takes great pride in exhibiting it. A call was sent in from the patrol box at the corner of Willoughby avenue and Fleet street to the stables, which are located nearly a mile from this point, and in three minutes and a half from the time the signal was sent over the line a patrol wagon with two officers arrived at the box. A visit was next made to the Fourth Precinct Police Station, which is fitted up with the latest improved apparatus, both telegraphic and telephonic, for communicating with any of the various precincts or headquarters. Under the new system the work of the officers in charge of the various police stations is not only very greatly reduced, but is performed in a much more intelligent manner and with greater dispatch. After leaving the Fourth Precinct several boxes located in different parts of the city were examined and a call was made at the Fourteenth Precinct Police Station, which is in charge of Capt. Dunn, and is probably the handsomest building devoted to the purpose in the country. It is very completely fitted out with electrical apparatus. Electric bells are in every room. The gas is lighted by electricity, the apparatus for which purpose is located on the sergeant's desk in the main office. The telegraph and telephone instruments are finely finished and occupy a special room adjoining the main office.

We present herewith the portrait of Mr. F. C. Mason, Superintendent of Police Telegraph Bureau of the City of Brooklyn, as well as a view of his office at Police Headquarters. Although still a young man, Mr. Mason has, by ability and industry, risen from the rank of messenger boy to his present enviable position, and may look for even greater honors. Mr. Mason is an old time telegrapher, having entered the service in 1872 as manager of the H. & P. Telegraph Company, at Rhinebeck, N. Y. He was promoted to managership of the Poughkeepsie office for the same company in 1875. He was at one time manager of the Continental Telegraph Company, at 86 Beaver street, this city, and later on superintendent of the Northern Mutual Telegraph Company and superintendent of construction for the New York & New Jersey Telephone Company of Brooklyn. The position he now holds would tax any man's ability and energy. As an instance of his progressive spirit, it may be mentioned that he has now made arrangements for lighting and ventilating his office by electricity, and that he is experimenting with a storage battery equipment for patrol wagons at night.

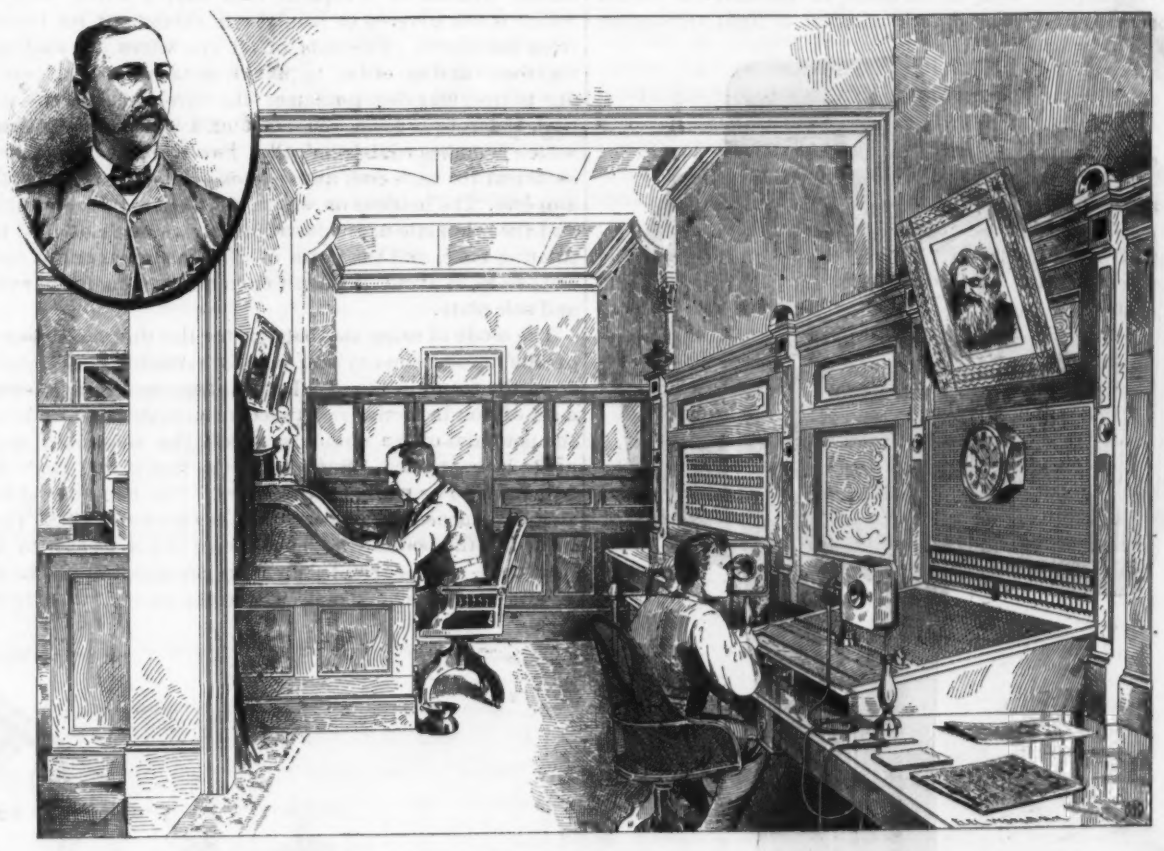


FIG. 2.—POLICE TELEGRAPH BUREAU, BROOKLYN, N. Y.

Electricity in a Stamping Mill.

A recent application of the electric motor worthy of special note is its use in stamping mills. A Sprague motor is now at work in Idaho driving a stamp mill situated four miles from the prime source of power. There are five batteries of ten stamps each. The stamps have forty drops a minute, and a dead lifting weight of 6,000 pounds to a battery, the total energy required being 75 h. p. It will be evident at once that a transmission of power in this way enables a manager to locate his mill directly at the mine. In this case, he gets 75 per cent. of the prime power, and is saving $90 a day on haulage alone. Illustrations of this kind do not take long to convince mine-owners of the advantages of electric power.

Clark Standard Cells.

BY DURAND WOODMAN, B. S.

Notwithstanding the exceedingly satisfactory results obtained by Lord Rayleigh, and the high estimate placed by him and others on the accuracy and value of the Clark standard element, the notion prevails to a considerable extent that his results are so difficult of duplication as to make a reliable Clark cell more a scientific curiosity than a *practical* standard of electromotive force.

Taking up the subject about a year ago at the request of Mr. J. W. Howell, of the Edison Lamp Company, a number of cells were made up which have been compared with each other on an average of once a week since the fourth day after their completion, without at any time recording a difference in their values of as much as one-tenth of one per cent.

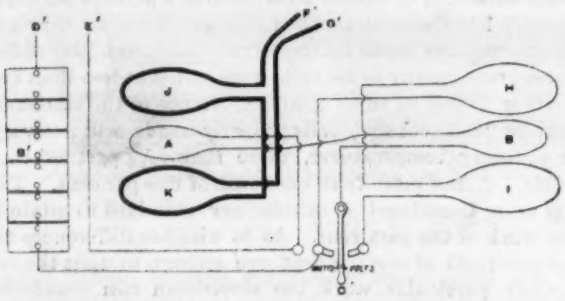
Six parts in 8,000 has been the extreme difference, and usually not over three or four parts, while agreement is frequently so close that the slight variations are not more than possible errors of reading or probable variations in temperature. 1°C. causes a variation of 8 parts in 10,000, or slightly less than one-tenth of one per cent., according to determinations made by Rayleigh. Although the differences among many of his cells were stated at less than two parts in 10,000, he sums up his experience in the statement that he "believes that cells properly made will not vary, at ordinary temperatures, more than $\frac{1}{1000}$ part of their value, *i. e.*, not more than one-tenth of one per cent." This has been considered a satisfactory standard to attain in the work of the past year. As to whether differences under one-tenth of one per cent. are enough to unfit the cell for any particular work, the electrician can decide for himself and undertake the preparation of a standard of greater accuracy for special cases. But for work of a very considerable degree of accuracy such small variations will not be of importance. A battery of six standard elements prepared for Mr. Edison's laboratory at Orange, one month after being set up, differed two parts in 8,000, and up to date no greater difference has been reported.

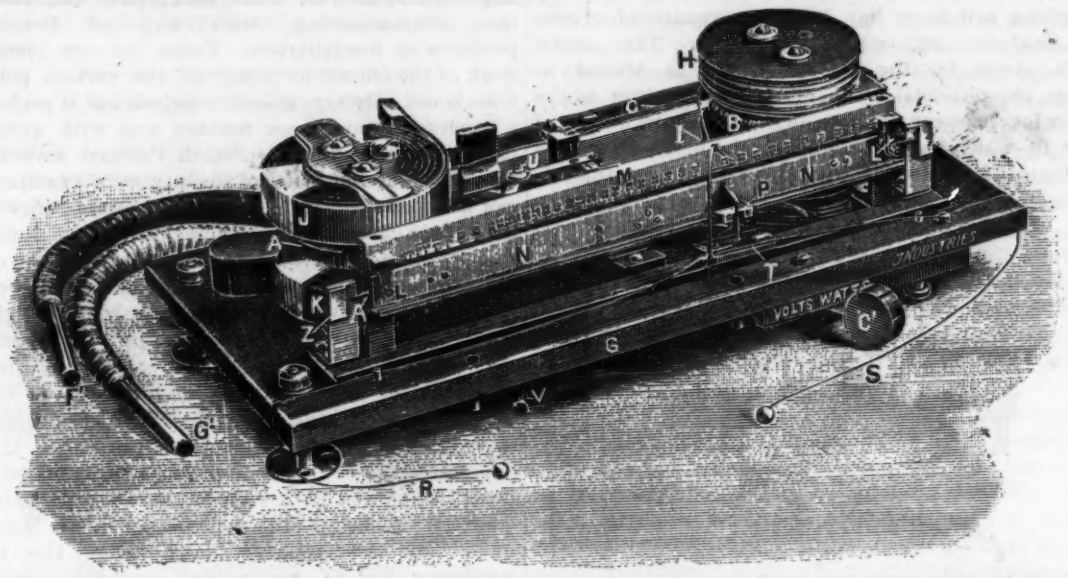
Its convenience of form and permanence *when properly prepared* are the reason why its employment would have been very general but for the shaken confidence resulting from disagreement of cells prepared by different persons, and want of permanence in many of those sold commercially.

Non-transportability except by hand has also been to some extent a drawback, and a modification whereby this difficulty has been overcome will be an additional point in favor of convenience. As to difficulties of preparation, not the least is the mechanical one of a satisfactory seal against evaporation, which is the only enemy to otherwise well-prepared cells. The remaining difficulties are purely chemical, and it is neither unfair to the amateur in chemical work, nor awarding too much to the chemist, to say that these difficulties are not likely to be appreciated or obviated by those without some training in exact chemical work. Not only is it difficult to purchase strictly pure chemicals, but also to prepare them, and where one article purchased may be all that could be desired, another will introduce a disturbing impurity; so that without analysis no purchased article can be safely used, unless one is willing to undertake the tedious and expensive method of trial and failure until something sufficiently good is obtained.

Sir Wm. Thomson's New Composite Electric Balance.

A new form of electric balance has recently been introduced by Sir William Thomson, which can be adapted either for the measurement of volts, of ampères or of watts. In the forms hitherto made and recently described in these columns, the range for current is from $\frac{1}{10}$th of an ampère to 500 ampères for continuous currents, and from $\frac{1}{10}$th of an ampère to 250 ampères for alternating currents. The range for volts is, as in all such instruments, only limited upward by the resistance available; but, as the resistance of the potential coils is about 40 ohms, the lowest potential which can be accurately measured is about 1 volt. These coils are of copper wire, and in consequence of the high temperature variation of that metal, very high accuracy is not attainable for such low potentials as necessitate the use of the balance without any resistance in its circuit external to its coils. Potentials of from 10 volts upward may, however, be measured with almost perfect accuracy with this instrument by introducing sufficient non-inductive resistance of platinoid or German silver wire into the circuit. For the measurement of potentials on alternate current systems, there should be at least 500 ohms of non-inductive resistance in the circuit.





FIGS. 1 AND 2.—SIR W. THOMSON'S NEW COMPOSITE ELECTRIC BALANCE.

The general form and construction of the new balance, as described by Mr. Thomas Gray in *Industries*, will be better understood by reference to Fig. 1, Fig. 2 showing the arrangement diagrammatically. Two coils of silk covered copper wire *A B*, made in the shape of anchor rings, are fixed to the two ends of a light aluminium frame *C*, which forms the beam of the balance. This beam is suspended in such a way that the planes of the coils are approximately horizontal, by two flat ligaments, as shown, both of which consist of twenty copper wires, each about $\frac{1}{10}$ mm. diameter. The suspension ligaments are about 1.5 cm. long, and are attached at their lower ends to two insulated brass tubes, carried on a trunnion, which passes across the middle of the aluminium frame. Their upper ends are attached to round pins, fixed horizontally, and with their length parallel to the trunnion, in two brass uprights, which are screwed to the sole plate *G* of the instrument. The suspension ligaments serve the double purpose of forming a flexible elastic joint about which the beam can freely turn, and of conveying the current into and out from the coils fixed to the beam. These movable coils are about 8 cm. mean diameter, and the cross section of the ring is about 1 sq. cm. Symmetrically placed with reference to each other and the suspended coil, one above and the other below the coil on the right hand end of the beam, are fixed two coils *H I*, of silk covered wire similar to that used for the movable coils. These coils have about the same mean diameter; but the cross section is rectangular, nearly square, and about 4 sq. cm. in area. Similarly placed with reference to the coil on the left hand end of the beam are fixed another two coils *J K*, which are capable of carrying strong currents. When the instrument is specially designed for continuous currents, these coils are made of copper ribbon of sufficient thickness to carry 500 ampères safely. When the instrument is intended for alternating currents, the conductor consists of a rope of thin copper wires, each of which is silk covered to insulate it thoughout its length from the others. The ends of all the wires are soldered together, and in order to avoid, as far as possible, error due to irregular distribution of the current across the section, the rope is given one turn of twist for each turn which it makes round the coil. Two turns of this rope is sufficient for each coil, and the maximum current is 250 ampères. The bobbins on which the fixed coils are wound, and the sole plate of the instrument, are made of good insulating slate, and the beam of the balance is cut at each end, so as to avoid Foucault currents in the framework and sole plate.

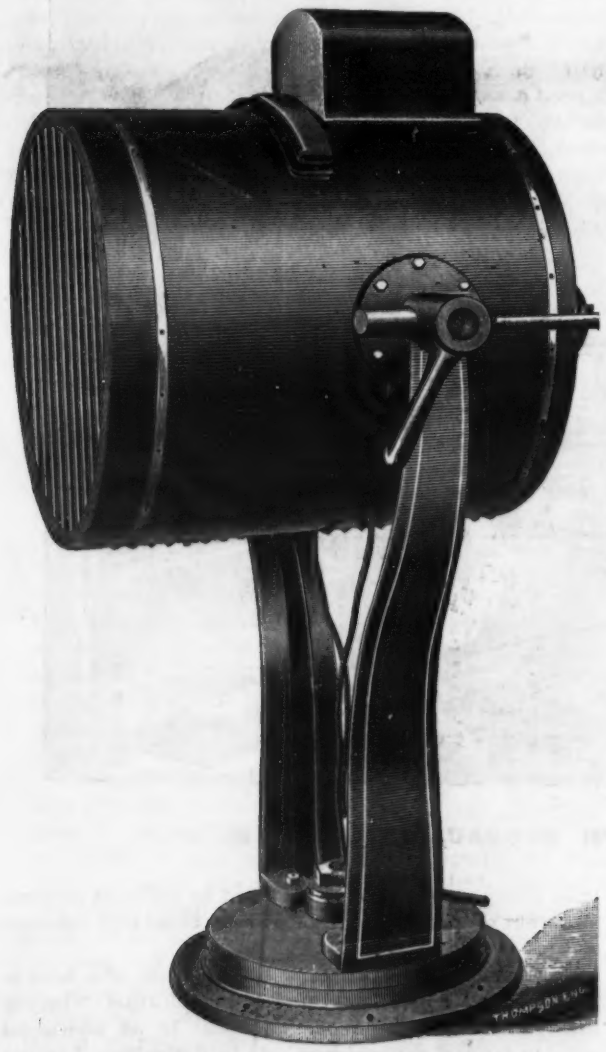
The mode of using the balance for the different classes of the measurements will be more readily understood from the diagram Fig. 2. In this diagram *B′* represents a set of non-inductive resistances of suitable magnitude for the potential of the circuit to which the suspended coils are to be connected. Suppose, in the first place, that the balance is to be used as a voltmeter. The handle *C′* of the switch is turned to "volts," and the electrodes *D′ E′* connected to the points whose difference of potential is to be measured. The current then flows through the electrode *E′* and the suspended coils *A B* to the switch, then from the "volt" terminal through the fixed coils *H I* to the "watt" terminal, and from that terminal through the resistance *B′* to *D′*. As the result of this current, the right hand end of the beam is deflected upwards, and the weight has to be pulled towards the right in order to restore the balance. The distance through which the weight has to be moved gives the couple produced by the ampèrian forces between the coils, and from the constant supplied with the instrument the potential between *D′* and *E′* is deduced. It will be seen that by this method of using the balance small currents may be measured. It is, in fact, a modified "centiampère" balance. The maximum current these coils are expected to carry is 1 ampère, and currents from $\frac{1}{10}$ to 1 ampère may be measured in this way.

Next suppose the instrument is to be used as a wattmeter. The switch handle is turned to "watts," the electrodes *D′ E′* connected to the supply mains, and the electrodes *F′G′* of the current coils *J K* connected to the two sides of a break in one of these mains. The whole current passing that break flows through the coils *J K*, and a current proportional to the difference of potential between the mains flows through the movable coils, but not through the fixed fine wire coils. The left hand coil of the movable system is thus acted upon by a force proportional to the product of the difference of potential between the mains and the current passing through them—that is, proportional to the rate of working in the circuit.

For the measurement of current, the strength of which exceeds 1 ampère, the instrument is used heterostatically—that is to say, a constant measured current is passed through the suspended coils, and the current to be measured is passed through the fixed current coils. The connections for this use of the instrument are the same as for the measurement of watts. When a constant E. M. F. is available, the current passed through the suspended coils may be measured by the instrument itself, by first turning the switch to "volts," and adjusting an external resistance so as to obtain the required current, and then turning the switch to "watts," and at the same time increasing the external resistance by an amount equal to the resistance of the fixed coils *H I*. Generally, however, a separate indicator or galvanoscope requires to be used in circuit with the suspended coils of the balance when it is used for the measurement of ampères. This indicator can, of course, be standardized by the balance itself, arranged for the measurement of small currents, and it need not be capable of measuring change of current, but it should be sensitive to such change.

A New Marine Reflector

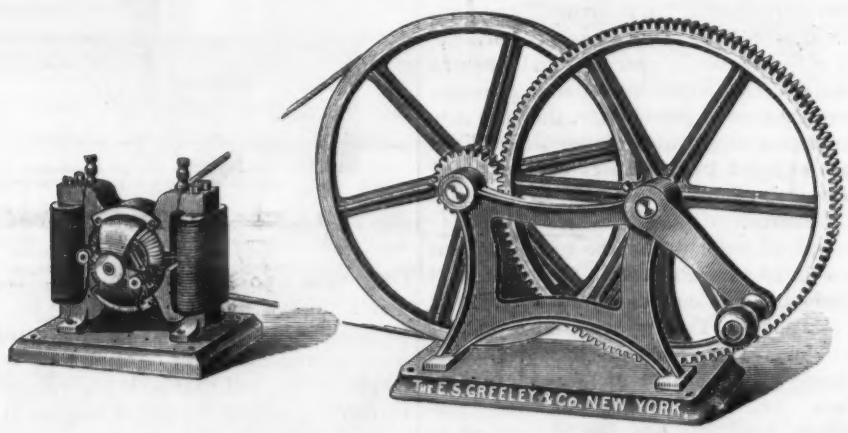
We give on this page an illustration of the new marine reflector made by the Thomson-Houston Electric Company. It is designed for use wherever a strong, intense light has to be projected a long distance. The lamp is of 6,000 candle-power, and will throw a brilliant light at a distance of one mile. The reflector is adjustable in all directions, so that any angle, horizontal or vertical, can be obtained, and is especially adapted for use on steamboats, at harbor entrances, by men of war, and in all places where a search light is needed.



NEW MARINE REFLECTOR.

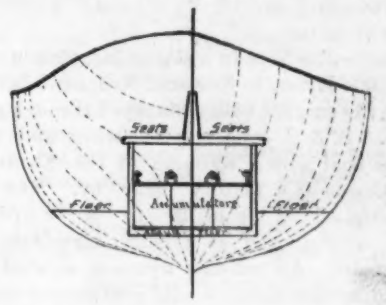
Experimental Apparatus for Schools, Etc.

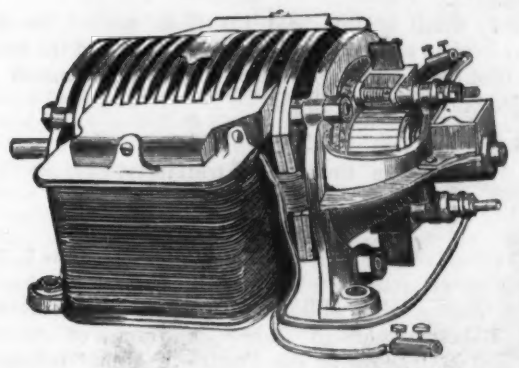
We illustrate herewith a small dynamo, with hand-power, recently introduced by The E. S. Greeley & Co., of this city. The machine, called the "Young Hercules,"



EXPERIMENTAL HAND DYNAMO.

is of such a size and capacity as to be very convenient for experimenters, schools and laboratories, as well as those who desire to produce spectacular effects for a short time in store windows, on the stage and elsewhere. The voltage of this dynamo is 60, and it has an ampèrage of 4. By the application of steam power it will light up six regular 20-volt lamps of 16 candle-power each, arranged in a series of three and two multiples. Even when operated by hand there is no difficulty in obtaining the required speed to light up four such lamps, two in series and two in multiple. The gross weight of the hand power itself is considerably less than 25 pounds, while the weight of the dynamo is 11½ pounds, making it, all in all, a very portable apparatus and one easy to set up and dismount.

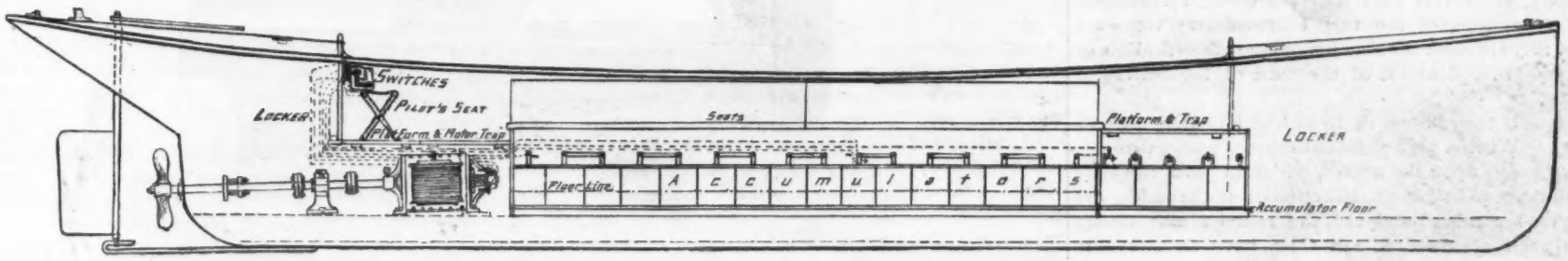


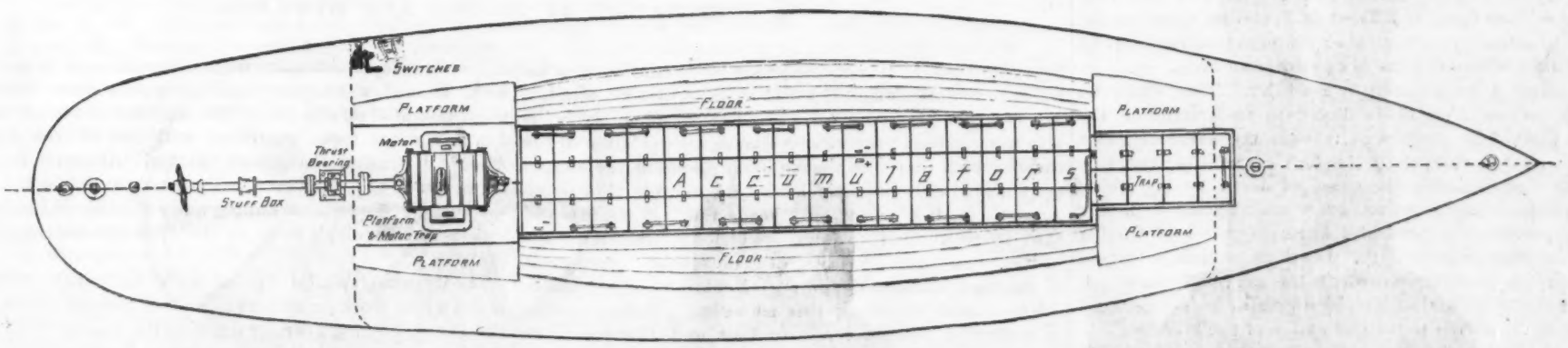


FIGS. 1, 2 AND 5.—THE ELECTRIC LAUNCH "MAGNET."

The Electric Boat "Magnet."

It is with pleasure that we describe and illustrate in this issue an electric launch which may be considered the first successful vessel of this class produced on this side of the Atlantic. The "Magnet," a full broadside view of which is presented by Fig. 1, has been designed by and is the joint property of the brothers Anthony and Frederick Reckenzaun, and was constructed in Newark, N. J., Messrs. G. H. and G. S. Seybolt of same place having built the hull. She is 28 feet long, with 6 feet beam and 3 feet depth amidship, and draws 30 inches of water at her stern. Figs. 2, 3 and 4 show the arrangement of the propelling apparatus, consisting of 56 accumulator cells, manufactured by the Electrical Accumulator Company of New York, one Reckenzaun motor, a gun metal two-bladed screw of 18 inches diameter and other appliances. The accumulators are of the "23 C" type, such as are used for propelling street cars, for lighting of railroad cars, etc., and are stowed away at the bottom of the boat immediately above and parallel to the keelson. Each cell weighs, with cover, etc., complete, a little over 40 pounds, the total weight of the 56 cells being about 2,400 pounds. They are contained in a trough, running along the centre of the boat, which with the covers and upright back form two rows of comfortable seats. The trough is lined inside with a coating of pitch and a bed for the cells is formed by a layer of sawdust at the bottom. The whole battery is thus securely inclosed, and the passengers and the hull are well protected. The motor is situated in the stern of the boat and fastened to a frame immediately above the keel. Its shaft is coupled directly on to the propeller shaft, thus avoiding the employment of cumbersome gearing. The motor Fig. 5 weighs 420 pounds, and is of exceedingly compact shape, having a narrow frame and base, snugly fitting into the curved lines of the hull—a feature which is most desirable in a boat. Two trap-doors give access to the motor, stuffing-box and thrust-bearing, and at the same time form a platform, part of which bears the pilot's seat. The motors and accumulators connect with two switches situated in convenient position for the pilot. One switch is turned for starting, stopping and reversing the motor. By means of the other the accumulators may be connected either in one series of 56 or in two parallel series of 28 cells each, thus allowing of variation in the speed of the boat. Okonite cable is used for all connections to insure good service in case of contact with salt water or acid. All of the machinery is easily accessible, and at the same time entirely out of the way, not occupying any space that might be used for passengers. About twenty passengers can easily be accommodated. The distribution of the accumulators and motor along the keel renders them a most advantageous ballast, bringing the centre of gravity a considerable distance below the water line, and the stability of the boat, as compared with that of a steamboat of similar dimensions, is most remarkable. No "dead" ballast is required to balance projecting weights, such as boiler and engines, every pound of machinery serving the double purpose of a propelling ballast, and there is no decrease in the weight of the same, as by combustion of fuel or consumption of water, etc. The total weight of the propelling arrangement, including accumulators, motor, shaft, screw, switches and wiring is about 3,000 pounds, which is about equal to the weight of boiler, engine, fuel, ballast, etc., of a steamboat of similar size. With the accumulators connected in parallel, the motor and screw make about 540 revolutions per minute, consuming an average current of 33 ampères, nearly 2¼ electrical horse-power, and driving the boat at a speed of from 6 to 8 miles per hour. One charge is good for a 10 hours' run, covering a distance of from 60 to 80 miles. If it is desired to increase the speed to from 10 to 12 miles, the switch is set so as to throw all cells in series, in which case the current and electromotive force are about doubled, delivering nearly ten electric horse-power, and decreasing the duration of the discharge to about one-fourth the above time, and the total mileage to about one half. Such extravagance is not always necessary, but in special cases economy is no object if high speed can be obtained. A steamboat of same size, with machinery sufficient to attain such speed, would leave very little space for passengers, not to mention the discomfort due to the noise, heat, smoke, ashes and grease which would accompany its use. Moreover, an electric launch when once charged may be kept ready for use at a moment's notice without preparation and waste of time; it will retain its charge, if not used, for weeks and even months, without appreciable loss. One man can easily act as engineer and pilot at the same time, the only attention the machinery requires when in service being the turning of a handle to start, stop or reverse it, or to change the speed. There being complete absence of dirt, the boat and its furnishings may be easily kept clean, and even ladies wearing delicate dresses may feel as safe and comfortable as in a parlor. While for a pleasure sail on lakes or rivers an electric launch is absolutely incomparable, the "Magnet" has proven to be, in spite of her small dimensions, to a considerable extent seaworthy, by a recent trip she made from Newark to New York and back again





FIGS. 3 AND 4.—PLAN AND LONGITUDINAL SECTION OF THE ELECTRIC LAUNCH "MAGNET."

in rather rough water, and at times in the swell caused by crowds of large steamers moving swiftly to and fro.

For sailing by night the "Magnet" carries seven 16-c. p. Sawyer-Man lamps distributed along the sides, suspended from the awning and on the flag staff, and from the forward awning stanchion a 100-c. p. Sawyer-Man lamp projects in front of a reflector, throwing a powerful beam of light ahead. The aspect of the boat gliding along smoothly with her lights at night is brilliant, and excites the admiration of all who happen to see her. The current for the lamps is furnished by the accumulators. The light is steady and practically constant, whether the boat is running or at rest.

The "Magnet" is kept in a slip at Mr. Brown's ship yard on the Passaic River, in Newark, N. J., and is charged at that place, the current being conveyed through about 1,500 feet of No. 8 B. & S. copper wire strung upon poles, connecting the boat with a dynamo at the Electrical Accumulator Company's factory near by. The charging current applied is from 20 to 30 ampères, at a difference of potential at dynamo terminals of from 140 to 150 volts. An ordinary dynamo, as used for charging a 60-volt accumulator, would also answer the purpose, in which case the battery could be thrown in parallel by means of the same switch used for varying the boat speed.

Every detail of this boat has been worked out with great care to be in harmony with the rest, and the results obtained have entirely fulfilled the anticipations of the projectors.

On Death by Electricity.

BY PROF. EDWIN J. HOUSTON.

The issue of THE ELECTRICAL WORLD for June 9, 1888, contains an article by Mr. R. M. Hunter, in which he states his general accordance with the exceptions taken by Dr. Robert Amory to some abstract of remarks by me on "Death by the Electric Current," before the American Philosophical Society of Philadelphia. The reply I have already made in the issue of THE ELECTRICAL WORLD for June 16, 1888, to the criticisms of Dr. Amory, as published, leave but little remaining as regards Mr. Hunter's objections. Still, as the subject is one of considerable public interest at the present moment, I may be pardoned if I add to what has already been said a few points as regards the opinions advanced by Mr. Hunter.

Mr. Hunter remarks in his article of June 9, 1888: "From my study of physiological phenomena, with special reference to the action of electricity, I feel convinced, etc., etc." If, as it appears, this refers to actual physiological experiments, I trust Mr. Hunter will publish the same in full, so as to permit the reasons for his conclusions to be better understood.

Although, as I have remarked in a previous article, I do not lay claim to any more than a general knowledge of physiology, yet I feel sure that the medical world will dissent from some of the very extraordinary views set forth by Mr. Hunter; notably his unique classification of death, and his explanation of the cause of the beating of the heart.

Speaking of the cause of death by high potential currents he says: "When a high potential current passes through the body it acts upon the nerves, which in turn cause an instantaneous and strong contraction of the muscles, and the nerves becoming paralyzed, the muscles may slowly release their contraction, but they have no power to further perform their original duty." If Mr. Hunter reads my reply to Dr. Amory's article he will find that Dr. Cavallo as early as 1795 set forth similar views as the result of actual physiological experiments carried on by him on the bodies of some of the lower animals.

Although I have carefully read Mr. Hunter's article, I must confess to no little difficulty in understanding the exact position he occupies as regards the cause of death by the electric current; in the first part of his article he asserts that primarily the cause of death by electricity is muscular exhaustion; muscular contraction no longer being possible, the "muscles have no power to further perform their original duty. Death is primarily caused by complete prostration through the nervous system acting on the brain, and such sudden prostration is continued by asphyxia, owing to the non-action of the muscles."

In the latter part of this article, however, he appears to favor the view that the cause of death is due to the paralzation of the nerves. "In the case of death from a high potential current the nerves are paralyzed, and they cannot perform their functions of exciting the muscular contraction of the heart, and hence any forced action of the diaphragm by manipulation may cause the air to enter the lungs and oxidize the blood in the lung capillaries, but the exciting current caused by such oxidation or slow combustion cannot excite the nervous action of the heart."

I am at a loss here to understand whether Mr. Hunter regards the true cause of death to be the failure of the nerves to perform their proper functions, or a similar failure on the part of the muscles. Assuming, however, on the whole, that he so far agrees with Dr. Amory as to ascribe the ultimate cause of death to the inability of the muscles to act, the real question remains as to the cause of such inability. I fail therefore to see in exactly what respect Mr. Hunter differs from the views as set forth in my remarks before the American Philosophical Society; or what he finds in Dr. Amory's objections to the same to lead him to say, "I was gratified to see in THE ELECTRICAL WORLD, May 26, an article from the pen of Dr. Amory stating objections, e c."

I note with interest Mr. Hunter's original classification of death, into death that is not death, and death that is death. "I term death," says he, "that condition in which a person is brought, causing the heart to cease beating, and permanent death the condition when resuscitation cannot take place." The death sentence under the old law, "to be hung by the neck until dead," or according to the New York method, to be electrified until dead, would appear, according to Mr. Hunter's classification, to need more explicit language.

Prof. Foster, a recognized authority in such matters, in his "Text Book of Physiology," published in Philadelphia, by Lea Brothers, 1885, remarks, on page 274, as follows: "Indeed, did it seem profitable, we might relate many other puzzling results which have been obtained in experimenting on the heart. We have already warned the reader that the problem of the causes of the normal spontaneous beat is as yet far from being solved, and until we get clearer views as to that main event we cannot expect to understand exactly how inhibition is brought about." It will, therefore, be of considerable interest to the physiological world to know that Mr. Hunter, as a result of his "study of physiological phenomena" is able to state that "the vitality due to the oxidation of the carbonaceous tissues in the capillary plexus of the human system gradually becomes less; and as this slow combustion is the cause of heat and electricity of the system, and which electricity through the nerves is the cause of muscular movement of the heart to cause the proper circulation of the blood, the heart not receiving this actuating exciting current in sufficient volume ceases to beat and the person is dead." Here, I presume, the meaning is *actually dead*, though it will be noticed that in accordance with this explanation the heart only ceases to beat because the stimulating current is not present, and the nerves, though they have an electrical current passing through them, fail to act properly because such current is not "in sufficient volume."

Since Mr. Hunter seems to have failed so completely in understanding the manner in which I believe death is caused by electricity, I will repeat that, in my opinion, these causes are

(1) Shock, or

(2) Electrolytic effects on the blood or other tissues of the body. To those, as I have stated, should be added disruptive effects in certain cases.

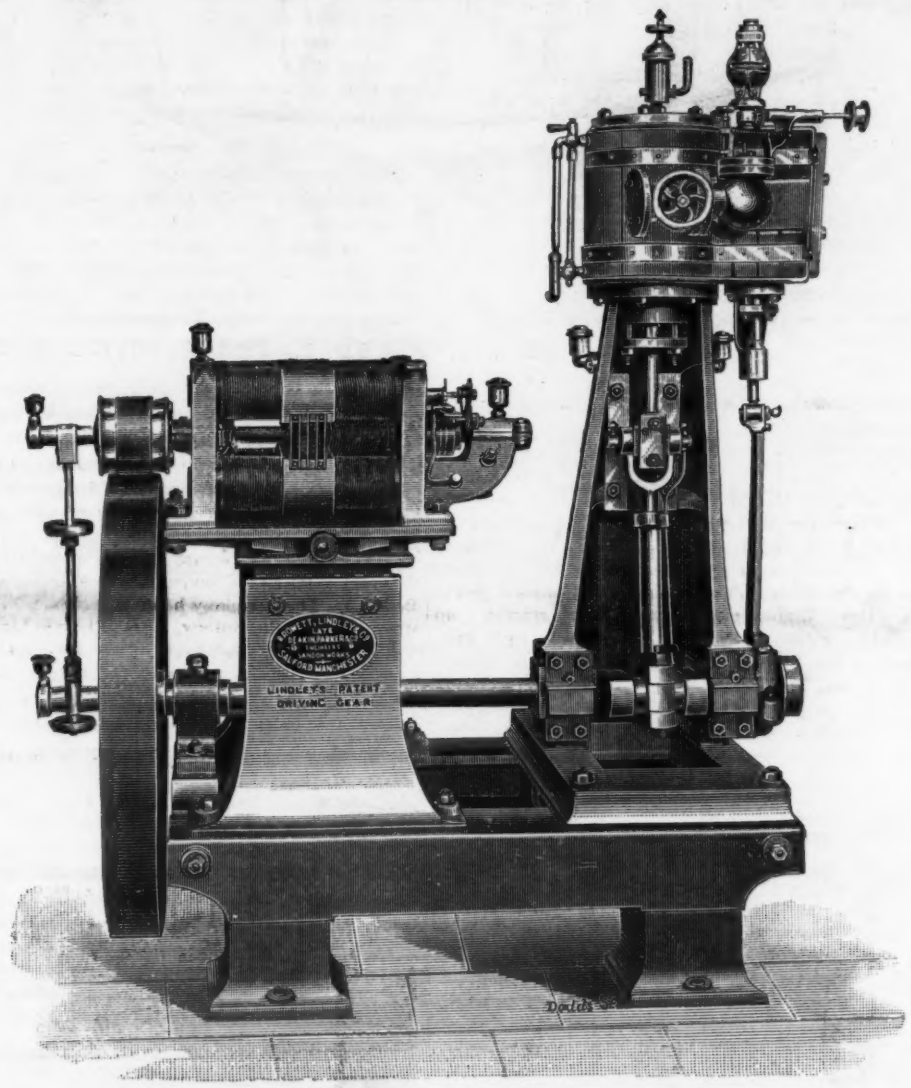
I also stated in the remarks before alluded to, "The greater or less probability of serious results will depend on the parts of the body through which the current passes. When any part of the body is placed in the path of an electric discharge, more of the discharge will pass through the better conductors, which perhaps will, generally, be the great nerve trunks and the muscles."

I take the liberty of quoting the following definition of the word shock from a "Dictionary of Medical Science, by R. Dunglison, M.D., Philadelphia, Henry C. Lea, 1874, page 946." "Shock. Sudden or instantaneous depression of organic, nervous or vital power, often with more or less perturbation of the body and mind, passing either into reaction or into fatal sinking occasioned by the nature, severity, or extent of an injury, or by an overwhelming moral calamity."

Except as regards the portions of Mr. Hunter's remarks that I have already referred to, I fail to see wherein the views set forth by me as regards the causes of death by electricity differ essentially from those set forth by himself.

Combined Engine and Dynamo.

At the recent Exhibition, at Manchester, Messrs. Browett, Lindley & Co., of Salford, showed several electric light engines, both simple and compound, among them the one shown in the accompanying illustration, for which we are indebted to the London *Electrical Review*. This



A COMBINATION OF ENGINE AND DYNAMO.

engine was in combination with a dynamo, and, as may be seen, formed a complete and compact electric lighting plant mounted on one bed. The engine was one of their 4 h. p. vertical types combined with one of the Anglo American Brush Corporation's "Victoria" dynamos, B_2 size for eighty 20 c. p. lamps. The dynamo was driven at 1,350 revolutions (the engine running quite steadily at 250 revolutions), by Lindley's form of the Raworth friction driving gear.

The dynamo spindle is fitted with an 8-inch friction wheel whose working surface is made of compressed paper, and the tightening gear for drawing the engine wheel and the dynamo pulley into harder contact is arranged so that it also serves to separate their surfaces to throw the dynamo out of gear. The vertical table on which the rockers and dynamo ride is adjustable vertically by a screw, and can then be clamped in position so as to keep the surfaces of the wheel and pulley in fair contact across their whole faces. The bolt, which will be seen as running through the frame at the centre, is simply a safety bolt to prevent the entire unshipping of the dynamo, when the plant is used on board ship, through violent oscillations of the whole.

The entire plant ran very smoothly and almost silently (a qualification very essential for a yacht) and the speed is well controlled and also capable of adjustment by the "Acme" governor fitted to the engine. The general construction is such that any type of dynamo can be very easily mounted on two rockers and placed on the table, and the dynamo is at a very convenient height for manipulation, being also very free of access.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, June 18, 1888.

Electric Wires and Poles.

The subway commissioners are now moving to have the wires that run over the conduits taken down and put underground, and it is said that many of the wires will have been transferred in two or three weeks. The board has ordered a conduit on Lexington avenue, for the benefit of the fire department headquarters in Sixty-seventh street.

Lead Incasing Works.

Robertson's Lead Incasing Works, 171 Water street, Brooklyn, N. Y., are owners of patented improved lead incasing machines for manufacturing in any length and diameter lead covered wires and cables. These machines will also cover wires with any compound insulating material. This company make a special insulating compound, which they will apply to any wires or cables on demand at short notice for insulated wire and cable manufacturers or individuals. They also apply any special compound that may be requested, having boilers, drying machines, and all necessary apparatus for the purpose. They are now covering 1,400 feet in one length of the Brooks anti-induction cable for the Bell Telephone Company of Philadelphia. They will apply the Brooks special compound and lead incase it. They have lately completed some 100-wire cables for the New York and New Jersey Telephone Company for their underground work in Brooklyn.

A Popular Electrician.

Mr. C. J. Field, the electrical engineer of the Edison United Manufacturing Company, 65 Fifth avenue, N. Y., received his colleagues, old college classmates and friends at his wedding reception, in the City of Churches, on Monday, the 11th of June, after an extended wedding trip. There were several hundred in attendance. Mr. Field is held in high esteem among his colleagues, who, to show their appreciation, presented him with a solid silver tea set. Elegant gifts were also presented by the officers of his company and others, in silverware, bric à-brac, dinner and tea sets, furniture, etc., which covered the tables, floor and all the available space.

Edison Plants.

Mr. C. A. Benton, agent for the Edison United Manufacturing Company, has, during his service with the company, introduced some 50,000 and more lights. Among some of his latest achievements is the sale of a 50,000 watt (75 b. p.) Edison generator to G. F. Hall, 211 Centre street, New York, to supply current for power in that neighborhood. Sprague motors will be used. Thurber, Whyland & Co., the big grocers, have taken a 40 h. p. Edison generator to supply their Sprague motors, some of which are now in use on elevators. This is also Mr. Benton's work. The Oswego Gas Light Company lately started up their 750-light Edison machine furnished by him. The steam plant for this installation was put in by the Kingsford Iron Works, of Oswego, of which Kingsford, of pure starch fame, is the founder and mainstay. They make high-speed engines, Corliss engines, boilers and appliances used in steam plants. Mr. Ed. Stokes, who recently purchased Fenwick Hall, at Saybrook, Conn., has bought a 300 light plant from Mr. Benton, who is installing it in his usual first-class style.

Tools for the Edison Phonograph Company.

Mr. E. P. Bullard has lately completed his big order for the Edison Phonograph Works at Orange, N. J., where some of his latest improved lathes, planers, tools, drills, presses, etc., may be found. There is an excellent demand for his Bridgeport tools and machines. Mr. Bullard has just brought out a new turret lathe, 2⅝ hole in spindle, friction clutch head, designed especially for steam engine and other heavy work.

Electric Leather Belting.

Chas. A. Schieren & Co. report recent sales of their Leather Link Belting to the following, for use on dynamos: Keystone Electric Light Co., Philadelphia, Pa.; Hudson Electric Light Co., Hudson, N. Y.; Mountain City Light, Heat & Power Co., Altoona, Pa.; Baldwin Locomotive Works, Philadelphia, Pa. The concern has just issued a special notice to the effect that they have exclusive right to the use of the word "Electric," which is stamped on every ten feet of the belting, and that they will prosecute infringers.

Electric Lighting in Brooklyn.

Governor Hill has vetoed the bill giving the Brooklyn Edison Company power to go ahead with its service over the opposition of the Brooklyn City Council, which is accused of being in league with the company now doing public lighting there. His ground for vetoing the bill is: "It violates the principle of home rule to which I am irrevocably committed." The Governor advises the people of Brooklyn, if they disapprove of the action of their Aldermen, to turn the objectionable officials out of the Council.

Electric Light Line Wire.

Under the caption as above the Ansonia Brass and Copper Company has just issued one of the most tasteful folder pamphlets I have ever seen. The cover is of stiff card-board showing an arc lamp alight against a cloudy sky, with the circuit wires in bronze gilt. Across the cloud in similar bronze or copper lettering runs the title and other matter. Inside a historical sketch is given of the introduction of the Cowles patented fire-proof and weather-proof line wire, which has now been on the market for six years, and this is supplemented by various testimonials from Prof. Henry Morton and a number of large local electric light companies.

Edison Cash Stations.

The Edison United Manufacturing Company has issued a neat pamphlet of a score of pages well illustrated by cuts and diagrams, as to its work, especially in connection with the sale of electric light plants upon the cash basis in towns of 10,000 inhabitants or less. The company has issued also a circular calling attention to its rich designs in chandeliers, brackets, lanterns, etc., for electric light alone or in combination with gas. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, June 18, 1888.

Personals.

Mr. E. J. Richards, of the Thomson-Houston International Electric Company, who has been located at Palermo, Italy, for some time, is on a short visit to this city.

Mr. Samuel G. Stiness, general manager of the Pawtucket (R. I.) Gas and Electric Light Company, was on a business visit to this city last week.

Messrs. A. H. Henderson and Elias E. Ries, of Baltimore, Md., were in Boston last week. These gentlemen were guests at the rooms of the Boston Electric Club during their stay at the Hub.

Motor Sales.

Mr. Frank Ridlon, New England agent of the Baxter Motor Company, reports the following sales of electric motors during the last week: Two of ten and six horse-power respectively, at Lewiston, Maine; two of two and one horse-power respectively, at Attleboro', Mass., and two of one and one one-tenth horse-power respectively to the Rhode Island Electric Light Company, Providence, R. I.

Edison Lights in Boston.

Messrs. Paine & Francis, New England agents of the Edison United Manufacturing Company, report the following new installations of the Edison incandescent electric lighting in the city of Boston: 750 lights in the Hotel Berwick, now being remodeled for use as a sanitarium; 1,000 lights in the Boylston building, now in process of erection at the corner of Boylston and Washington streets; and 115 lights and a 10,000-watt dynamo (Edison) for supplying power to a Sprague motor to be used for pumping water 2,000 feet from the building. The wiring and construction work on all these installations was done by the New England Wiring and Construction Company, of Boston.

New Campbell Wire Factory.

The Campbell Electric Supply Company, of Boston, has finished its new factory building at Watertown, Mass., and everthing is in readiness for manufacturing its popular "Vulcan" wire. The factory is four stories high and its dimensions are 180 by 50 feet. Every department is supplied with requisite machinery and appurtenances for the various stages in producing the wire. I am indebted to the company's treasurer, Mr. F. E. Clark, for a very pleasant trip to Watertown and an inspection of the process of covering wire.

The Jarvis Engineering Company.

This active corporation has had its hands full of orders during the present month. Among its recent sales may be enumerated the following: A new double Armington & Sims engine of 100 h. p. and six new boilers, set with the Jarvis patent furnace, to go to New Bedford, Mass., the engine to be installed in the plant of that city, and the boilers to be set at the factory of the New Bedford Cordage Company. The Jarvis Company have an order in hand to set eleven boilers at the Wamsutta mills, also in New Bedford. The company have a contract in hand to equip the steam plant of the Quincy, Mass., Electric Light Company, which will embrace the following: Two Armington & Sims engines, aggregating 150 h. p.; one horizonal tubular boiler, set with Jarvis furnace and Sheffield grate bar; a National feed-water heater; a Korting injector.

Wainwright Feed-Water Heater.

The Wainwright Manufacturing Company, whose factory at Medford, Mass., was referred to in my letter of last week, has its manufacturing facilities taxed to their utmost, both in the feed-water heater and in the corrugated tubing departments. The company report the following shipments of feed-water heaters made recently: Seven to Providence, R. I.; three each to New York City and Philadelphia; two each to Boston, Lowell and Fall River, Mass.; Dover, N. H.; Bridgeport, Conn., and Chicago, Ill.; one each to Great Falls, N. H.; Abington, New Bedford, and Lawrence, Mass.; Putnam, Conn; Elmira, N. Y.; Pittsburgh, Pa., and St. Louis, Mo.

Leather-Link Belting.

Mr. Charles L. Ireson, manufacturer of Ireson's self-adjusting leather-link belting, Boston, Mass., has just issued a handsome little book, "A treatise on leather-link belting for all electrical purposes and other high speed machinery." The book is profusely illustrated, and is printed on a very fine grade of paper. It comprehensively describes the manner of constructing leather-link belts. A copy will be sent free of charge to any address, and should be applied for.

New Thomson-Houston Installations.

The Thomson-Houston Electric Company reports the following new installations: Asbury Sons' gas works, Greenville, N. C., 18 arc; Norfolk, Va., 70 arc; Hotel St. Louis, Duluth, 650 incandescent; Menominee, Wis., 150 incandescent; and the following increases: Patterson, N. J., 800 incandescent; Syracuse, N. Y., 1,000 incandescent; Atlantic City, N. J., 50 arc; Cheboygan, Mich., 20 arc; Crawfordsville, Ind, 30 arc: Paterson, N. J., 50 arc.

Death of Mr. A. F. Upton.

Mr. Albert F. Upton died suddenly at his residence at Newtonville, last week, from paralysis of the brain. He was out of doors during the forenoon, but at 1 o'clock he had an ill turn, and soon lost consciousness, passing away at 4:20 P. M. Mr. Upton was born in Peabody, Mass., and was 45 years of age. He had resided in Newtonville for 10 years, and was formerly a resident of Boston, serving in the city council in that city for two or three years. For several years he was in the leather business with his father, and he afterward became the treasurer and general manager of the Jarvis Engineering Company of Boston, and retained that position until his death. He was a stockholder in numerous electric light companies, and a director in the Newton Electric Light Company and in the Newton Electric Street Railway Company. During the civil war he served as first lieutenant and quartermaster in the 35th Massachusetts Infantry. During his residence in Newton he had taken an active interest in the affairs of the city, and represented his ward in the common council in 1884 and 1885. He was the representative of the city government in the water board in 1885 and served on the committees of state aid and military affairs, fire department and highway during his connection with the city council. His wife died four years ago. Two daughters survive him. At his funeral there was a very large attendance of relatives friends and former business associates, including a delegation from the Loyal Legion, the Newton city government and the Jarvis Engineering Company. The floral tributes were very beautiful. The remains were interred in the Newton cemetery. The following gentlemen acted as pall bearers: Messrs. H. B. Parker, William F. Hawley, S. L. Putnam and H. F. Ross. The Jarvis Engineering Company has adopted a series of resolutions expressing its feeling of great loss and condoling with the bereaved family.

The Thomson-Houston Railway System.

In the following cities roads are now in operation: Ansonia, Conn., 4 miles; Appleton, Wis, 4.50; Binghamton, N. Y., 4 50; Detroit, Mich., 2; Fort Gratiot, Mich., 1.75; Jamaica, N. Y., 10; Woonsocket, R. I., 4; Montgomery, Ala., 11; Port Huron, Mich., 4; St. Catherines, Ont., 6; Scranton, Pa., 5; Wheeling, W. Va., 5.25; Windsor, Ont., 1.75; Lima, Ohio, 4; St. Paul, Minn., 10.

The following are using Thomson-Houston motors: Allegheny City, Pa., 4 miles; New York, N. Y., 1 mile.

The following are in course of construction: Wichita, Kan.; Dayton, Ohio; Omaha, Neb.; Scranton, Pa.; Chattanooga, Tenn.; North Adams, Mass.; Salisbury, Mass. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., June 16, 1888.

Engines for Lighting.

Four thousand horse power in Armington & Sims engines have been contracted for for the Philadelphia Edison Company's new station on Sansom street. Each engine will drive two 1,000 ampére Edison dynamos, equal to 4,000 lights to each engine. The Edison Company are putting down what will probably be the most extensive system of underground electric light wiring in the world, when finished. It is their standard system of tubing. The United States Electric Lighting Company are installing in the Allegheny County court-house and jail, Pittsburgh Pa., a 4,000-light plant (incandescent), together with a system of motors for driving the ventilating fans and elevators. The plant will be driven by three 15½ in. x 15 in. and one 8½ in. x 10 in. Armington & Sims engines. John T. Bailey & Co.'s extensive rope and cordage works are about to be lighted by the United States system (incandescent), driven by an Armington & Sims engine. The American Electric Manufacturing Company are increasing their plant at Atlantic City with an additional 200 arc lights, there are already three Armington & Sims engines in this station; two more are being added to it.

New Lighting Work.

Walker & Kepler, Edison Company's agents are busy installing, in connection with other work, a very considerable increase at Harrison, Frazier & Co.'s extensive sugar refinery. C. A. Bragg, of the United States Company, is doing the same for E. C. Knight & Co.'s refinery. The new and handsome Drexel office building is rapidly nearing completion and is being wired by Walker & Kepler for a 4,000-light plant, to be run with Armington & Sims engines. The work in this building is to be the best that electrical and steam engineering can make it, and is being done under the direction of Mr. C. H. Darrach, of Wilson Bros. & Co., architects and engineers for the building. Prominent among other installations lately put to work is the new Edison plant at St. Johns Industrial School, Eddington, a Catholic institution, a few miles north of Philadelphia, endowed through the liberality of the Misses Drexel; Galloway boilers and Armington & Sims engines form the motive power. The effects produced in the chapel by the incandescent lights are more than beautiful, and the good brothers of the institution are to be congrated upon their very handsomely lighted building.

At the Beneficial Saving Fund, 12th and Chestnut streets, the element of absolute quiet was a stringent requirement. A combination of the Edison system and Armington & Sims engine produce the desired effect, and no noise whatever from the lighting plant can be detected in the board room, directly over the engine and dynamo room.

Gloucester, N. J.

Mr. J. R. Simpson, of the American Co., has illuminated the poor man's Atlantic City, Gloucester, N. J., with a 75 arc arc light plant.

J. W. Queen & Co.

Messrs. James W. Queen & Co., whose electrical department is growing so rapidly that it will soon be one of the largest establishments in the country, have just issued a new, interesting and handsome catalogue of electrical instruments. I hope to speak more extendedly of the contents of this work next week. Mr. Walton, who has charge of this branch of the firm's business, has also issued a neat little work, giving the result of his observations while on a recent trip to Great Britain and the Continent in search of new instruments and novelties in general.

W. A. Doty.

Mr. William A. Doty, who recently purchased the manufacturing department of Vallee Bros., at No. 727 Filbert street, has been compelled to work his force of mechanics at night in order to meet the demand for goods. His success is well deserved.

A Queer Boycott.

A dispatch from Hazleton, Pa., says: Writs have been served upon a large number of the business men of Freeland by Deputy Sheriff Iredcott, of Luzerne County, to answer the charge of conspiracy in boycotting George E. Hill, manager of the Freeland Gas and Electric Light Company, during the miners' strike in November last. Notice was duly served on the said company, at the instance of the Knights of Labor, to the effect that unless the scabs employed by them were discharged the light would be shut off in all their stores. This blow was aimed at Hill, and consequently he was discharged. He has brought suit against the parties who were instrumental in the discharge, and who raised the cry of "scab" and made him a victim of boycott for no other reason than that he once was policeman at Perth Amboy, N. J., during the coal-handlers' strike.

Benson & Thompson.

Messrs. Benson & Thompson, of 3,015 Chestnut street, have just issued a handsome card of samples of the various grades of insulated wire turned out by them. Interested parties will do

well to secure one of these cards, and to request prices from this enterprising firm.

Underground Work.

There seems to be no end of underground work now going on in this city, all of the companies, and notably the Penn Electric, working night and day. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, June 16, 1888.

The Franklin Motor Company.

The Franklin Motor Company, Detroit, Mich., has just opened a branch office at 163 State street, Room 21. The motor manufactured by this company is designed for light service, being now made in sizes up to ⅓ horse-power. The office will be under the management of Mr. John C. Liggett.

Personal.

Mr. S. A. Duncan, of Pittsburgh, president of the National Electric Light Association, was in the city this week en route to Colorado, where he will spend two weeks in the recuperation of his health. Mr. Duncan is just recovering from a severe attack of pneumonia.

Mr. J. L. Barclay, selling agent for Holmes, Booth & Haydens, reports the sale of higher grade insulating wire, such as the K. K., steadily increasing, in fact being equal to that of underwriters'.

Mr. F. W. Horne, Western manager of the Excelsior Company, is back from his trip east much improved in health.

On Thursday, June 14, Mr. F. S. Terry, Mgr. of the Electrical Supply Company, was presented by Mrs. F. S. Terry with a daughter. The many friends of the popular manager will join in congratulating the happy parents.

Mr. J. F. Wollensack, the well known manufacturer of electrical supplies, speaking tubes, etc., reports the doing of a good amount of business for this season of the year, with a promising outlook for later in the season.

The Telephone Question.

The question as to the authority of the city to define the price to be charged for telephone service by the telephone companies has been taken up by Corporation Counsel Green. It had been assumed that the State legislature alone have the power to fix prices to be charged by quasi-public corporations. It is probable that the telephone question will again be taken up by the Council, inasmuch as the Supreme Court of Missouri has decided adversely.

New Corporation.

The Chicago Light Company, of Chicago, was granted incorporation license by the Secretary of State, June 11. The company is to sell power and light produced by electricity; capital stock $20,000; incorporators, Jessie Scribner, Charles F. Clark and M. J. Grogan.

Electrical Construction Company.

The Electrical Construction Company announce their intention of making a specialty of model and experimental work, developing inventions, etc., for which they are adding to their factory special machinery, tools, etc. The company report business good in the wiring of buildings.

The Central Electric Company

have secured the exclusive agency for the Stoddard cut-off, which they are introducing to the electrical trade. The device is said to be simple and effective, and has received the indorsement of experts as being one of the best yet produced. The company report trade in the Candee aerial wire, like the Henrietta, "still booming," some large orders having recently been received.

The Western Electric Company.

I found business at the factory of the Western Electric Company very brisk when I called this week. In every department there seemed to be great activity. I was informed that in the cable department business was unusually brisk, the demand for the Patterson cable being great; also the demand for fire-alarm apparatus, and Field & Firman messenger box for district service was very active. The output from the bell department is also large.

The Price of Gas Fixed.

Mayor Roche informed the gas companies last week of the action of the Council in placing the whole gas question "on file." Thereupon they immediately came in and agreed to furnish gas at the uniform price of $1 to the city and $1.25 to private consumers in all parts of the city. The contract for the city gas at this price will date from the beginning of the year, while the reduction to private consumers on the west side will commence immediately. This practically solves the gas question for the present, and it is said that the Mayor and Aldermen are satisfied.

A New Electric Street Railway Corporation.

The Secretary of State on June 11 issued license of incorporation to the Ottawa Electric Street Railroad Company, at Ottawa, Ill.; capital stock $100,000. Incorporators: T. J. Grans, W. E. Rowan, G. S. Eldridge and James Briggs.

Cincinnati, O.

The Hauss Electric Company, this city, had a fire Tuesday night. Loss about $1000, mainly by water, and to raw material and wire.

C. E. Jones & Bro., general electricians, report trade as being brisk.

A large force of linemen are engaged in wiring the Centennial exposition buildings in this city. The prospects are that the display of dynamos and motors will be large and interesting.

The local electric light companies receive requests daily from home and out of town exhibitors for prices of current for motors and lighting.

The George F. Card Motor Company are pushed to their fullest extent to fill their orders for motors.

The Brush Company here claim exclusive right to run lighting wires throughout Cincinnati, by virtue of certain resolutions of the Common Council, etc. But some people are inquisitive enough to desire to know who authorized that body to delegate the rights of the people to a private corporation.

Electrical Supply Company.

The Electrical Supply Company have just added to their stock a very large and complete stock of testing instruments, comprising nearly all the well known instruments in use among electricians. The instruments are now on exhibition. Among sales reported by this company during the present week was a large order for Kerite cable for underground work in a Western city.

The Baxter Electric Motor and Manufacturing Company.

A visit this week to the Western department of the Baxter Electric Motor and Manufacturing Company, Mr. W. W. Munroe, manager, elicited the fact that the department is very busy just now. At Sault Ste. Marie, Mich., the power circuit has just been started up, using the Baxter motor. At St. Cloud, Minn., the Gas, Electric Light and Power Company of that city has also just started a power circuit. The motor circuit at Grand Rapids, Mich., is now in operation, ten motors having been installed upon it within the past few weeks. Mr. Munroe tells me that the demand for the larger sizes of motor is increasing and his department is now negotiating with several parties for motors from 10 to 15 and 20 horse-power each. Since the establishment of the Western department, which occurred a few months ago, over 30 orders have been placed in Chicago alone, besides which some 15 important orders are now pending. Mr. Munroe regards as the best evidence of the efficiency and superiority of his motor the fact that no trouble to date has been had with it in any of the installations which have been made, as it is giving entire satisfaction.

Leonard & Izard.

Messrs. Leonard & Izard, general agents for the Edison Company, have just contracted to install a central station plant at Leon, Ia., consisting of 300 incandescent lights.

The New Auditorium Plant.

I have before referred to the temporary lighting of the new Auditorium, where the National Republican Convention is to be held next week. About 2,700 incandescent lights will be required to light the hall, the installation of which by Messrs. Leonard & Izard, agents of the Edison Company, has just been completed, and the lights tested. The decorations of the hall are handsome, and will be appropriate for the occasion. The ceiling decorations directly above the audience consist, in part, of immense stripes of red, white and blue muslin drawn taut from end to end. The elliptical arches, nine in number, come next. Between each of the arches stars of incandescent lights are placed There are twenty-two of these, six feet in diameter, twelve of which stand in four rows directly above the pit, ten being placed on the walls at the right and left. In addition to these, twenty-six smaller stars are placed directly in the centre of the wall and form a crescent. The novelty, however, is an immense shield of incandescent lights standing directly above the proscenium arch 8 × 10 ft. It represents the stars and stripes, 150 incandescent lights of red, white and blue making up the shield. Each of the elliptical arches has 60 lights.

The Sprague Equipment Company.

On June 12 an incorporation license was issued by the Secretary of State to the Sprague Equipment Company, of Chicago; capital stock is $50,000. The company purpose to furnish electric equipment for the propulsion of cars on street, elevated and general railway systems; the building of street railways and the installing of electric motors and dynamos for power and light. The incorporators are J. L. Barclay, Wm. H. Fairclough and H. J. Bavin.

Thomson-Houston Company.

The Thomson-Houston Co., among other orders just received, report the sale of a plant to the Monroe Electric Light and Power Co., of Monroe, Wis., consisting of 500 incandescent and 50 arc lights for lighting the city; also the sale of 15 arc lights to C. E. Brown, of this city, for lighting his block on Cottage Grove avenue.

Lincoln, Neb.

The Western Engineering Company has just closed a little contract at Kearney, Neb., that will doubtless be of interest to your readers. Kearney is a very pretty little city in the centre of Nebraska, and midway, it is claimed, between Portland, Me., and Portland, Oregon. It is located under the bluffs of the Platte River. The Platte is a broad shallow stream, with a sandy bottom and unlimited water. The Kearney Canal Company has dredged out a great "rising basin" on the bank of the Platte, seventeen miles above Kearney. This basin furnishes an unlimited supply of water, and from it a canal is led along the river bluffs to Kearney, at which point there is an available fall of nearly 100 feet between the top of the canal waste weir and the Platte River. The Canal Company has lately placed a "twin" pair of "Victor" turbines in position that will develop 350 horse-power, and plans are laid for placing more wheels. These wheels, running under a high head, make a very steady prime mover. For several weeks an arc-light plant of the Kearney Electric Light and Power Company has been driven from the wheels with great satisfaction. The company has now just contracted through Mr. Coster, of Omaha, for an incandescent plant of 1,000 lights, Edison system, to be driven by the wheels. The Western Engineering Company are also furnishing two Sprague motors, aggregating 50 horse-power, which will drive the works of the Kearney Pressed Brick Company. The motors will be placed on the lines of the incandescent plant, and as soon as they have shown their reliability in handling their work other manufactories now located at Kearney will at once adopt the electric power. More manufactories have already signified their location at Kearney to take advantage of cheap water power distributed through the agency of electricity and the Sprague motor. We here have a first step towards placing manufacturing on a practical footing in the State, where the high cost of coal has heretofore been prohibitive. Doubtless Kearney will soon present an example of electric power distribution on a large scale.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$160	@ $165	Iowa Union	$27	@ $28
Central Union	47	@ 48	Michigan	79	@ 80
Chicago	350	@ 375	Missouri and Kansas	70	@ 71
Colorado	19	@ 21	Rocky Mountain Bell	40	@ 45
Cumberland	65	@ 68	Wisconsin	108	@ 109
Great Southern	35	@ 40			

E. L. P.

ENGLISH NOTES.

LONDON, June 6, 1888.

Prof. Silvanus Thompson on Influence Machines

The Society of Telegraph Engineers held their concluding meeting for the present session on Thursday evening last, when a highly interesting address was delivered by Prof. Silvanus P. Thompson on "Influence Machines." The lecturer exhibited an imposing collection of machines, illustrating the development of the apparatus from the first conception of the possibility of multiplying the electric charge by influence, down to the magnificent eight-plate Wimshurst machine, which gives sparks of 14 inches in length without Leyden jars. Prof. Thompson, a little unfairly, let us in without previous warning for the celebration of a centenary, the Nicholson doubler having been exhibited before the Royal Society for the first time on the 5th of June, 1788. This was the first practical application of the principle. All the early writers on the subject, however, mention the name of Erasmus Darwin (the grandfather of the great Darwin) as having been the real discoverer of the principle of accumulation, and Prof. Thompson has devoted a great deal of time and labor in the attempt to find out what Erasmus Darwin really did. He waded through enormous piles of contemporary periodical literature in the British Museum Library without getting any nearer to the object of his search. At last it occurred to him to ask Mr. Horace Darwin, of Cambridge, whether he had any unpublished manuscripts of his great grandfather which might throw light upon the subject. After considerable trouble Mr. Darwin succeeded in discovering a torn sheet of paper, dated about the middle of the last century, upon which a rough sketch of the machine itself was drawn. Professor Thompson exhibited to the meeting a fac simile of the drawing, which was examined with the greatest possible interest. It cannot be said that the design presented any particular merit, it being nothing more than a mechanical arrangement for going through the usual operations for obtaining a discharge from an electrophorus. Nevertheless, it stands upon record as the earliest attempt to produce a static discharge by mechanical means without resorting to continuous friction. Among other interesting machines exhibited were some of the early devices of Sir W. Thomson, in which the influence principle was employed to obtain the static charge for the electrification of the ink in his siphon recorder. One of these machines in particular is the exact analogue in statical electricity of what the dynamo is in dynamic electricity, but it would be difficult to explain this fully without the aid of diagrams. At the conclusion of the lecture Mr. Wimshurst set in motion his great machine and a miniature thunder-storm was produced.

Edison-Swan v. Anglo-American Brush.

The lamp patent case has been adjourned until June 10, in order to carry out a very sensible suggestion of Mr. Justice Kay, namely, that a series of experiments should be made upon the lines laid down by Edison in his specification, and that they should be carried out by a joint committee consisting of a certain number of experts nominated by each side and some independent authority, who will be nominated by the judge himself, to act as "moderator," and whose report will be received as independent evidence. The names of the parties selected have not at present been made public. It was high time that something of this kind should be done, inasmuch as a great deal of the evidence was of a totally conflicting character, such, for instance, as that for and against the practicability of carbonizing in sand. It is impossible to avoid remarking that it does seem a little absurd to put a man into the witness box to swear that he tried to carry out an experiment, but did not succeed, when there is at least the possibility that he was rather anxious to fail. With reference to the scope of this proposed committee, Mr. Finlay, Q. C., asked Mr. Justice Kay if the lamps made by the experts were to be tested for duration; to which the judge promptly replied that, if the lamps were run until the case ended, he thought their durability would be sufficiently proved.

Amalgamation of Incandescent Lamp Companies.

An extraordinary general meeting of the Swan United Electric Light Company was held yesterday in order to accept an agreement which has been entered into by the directors of the company for the amalgamation of their business in European countries with that of the Paris Edison Company. From the statement of the chairman it appears that the Paris company is working under an agreement with Edison to pay him a royalty of twenty centimes upon each lamp manufactured. This agreement was to run for the whole of the term of the existence of the company and not merely until the expiration of the patent. Under the terms of the amalgamation, however, it has been agreed that Edison shall waive his right to this royalty after Dec. 31, 1894; but meanwhile it will be paid on all lamps made by the United Company. The total share capital of the joint companies will be £80,000, of which £40,000 is to represent in fully paid shares the values of the joint businesses as a going concern, and the remainder of the capital is to be made up of cash, which will be contributed by the two parties in the same proportion in which the profits are to be divided; this proportion is 60 per cent. to the Edison Company and 40 per cent. to the Swan Company. Taking into consideration that the Edison Company are doing a far larger business at the present moment than the Swan Company, and also have established numerous agencies in various parts of the continent, which may be expected in the near future to give rise to important developments, the share acquired by the Swan Company probably represents a very fair proportion. At any rate the shareholders raised no objection at the meeting and appeared perfectly satisfied. One other point should be mentioned, that is that the agreement does not at present apply to Germany. In this country the two companies are already in an advanced stage of litigation, and, while it is hoped that an amicable agreement will be arrived at, for the present matters are to go on upon the same footing as heretofore. One other point is of interest, namely, the terms of agreement between the French Edison Company and Messrs. Siemens & Halske, of Berlin; it appears that the latter are paying a royalty of 37½ centimes for each lamp that they manufacture. This payment will continue in force.

Telephone Amalgamation.

The movement for the amalgamation of the various telephone interests seems to hang fire. So far as can be gathered the delay

arises on the part of the United Telephone Company—the parent company—whose shareholders are probably content with the dividends they already receive, and are in no particular hurry to embark in any movement which may appear to partake in the least degree of a speculative character. However, it is still confidently anticipated that the amalgamation will be brought about.

Coast Telegraphy.

A bill now before the House of Lords proposes to grant powers to Lloyd's Shipping Committee to acquire land and erect telegraph lines for signaling purposes all around our coasts. This bill has aroused some opposition, as it is thought that the scheme should be carried out upon a more extended scale by the government itself, not only for the purposes of the mercantile marine, but also to aid in the coast defenses. During the naval operations last year, the lack of communication from point to point along the coast was much commented on; indeed, the utility of a coast-guard look-out station which communicates nowhere is scarcely apparent. There is little doubt that something of this kind will be done, and if the scheme is carried out to anything like its full extent it will involve a very large amount of telegraph construction.

The Public Safety Signal Association.

The Public Safety Signal Association, which is, I believe, of American origin, has induced Sir Charles Warren, the Chief Commissioner of the Metropolitan Police, to permit them at its own expense to erect a system of police signals in the district of Islington, and if successful, it is anticipated that the system will be adopted throughout the metropolis.

Continuous vs. Alternating Currents.

The numerous discussions on the respective merits of alternating currents and continuous currents which have taken place in the States have attracted great attention in this country, and our electrical journals from time to time reprint the various papers. The problem of alternate current motors is being investigated here with very great interest, and many patents have been filed within the last few months, although the time has not yet come for their contents to be made public.

The Hastings Electric Light Company.

The annual report has just been issued of the Hastings & St. Leonards-on-Sea Electric Lighting Company, which has been able to pay a small dividend. The company are making slow but steady progress, and they are anxious to raise the money on debenture bonds to enable them to extend their operations. Unfortunately, notwithstanding the payment of a dividend, such is the languid interest taken in this country in electric lighting, that they have not hitherto been able to get the modest sum of £5,000 for which they have appealed.

Lighting in Edinburgh.

A scheme has been set on foot in Edinburgh to establish a central lighting station at the back of Prince's street. Probably all Americans who have visited this country will recollect Prince's street, Edinburgh, which Scotchmen, not without reason, claim to be the finest thoroughfare in Europe. It is a matter for surprise that the electric light has not long ago been adopted there. It is understood that the present scheme is backed up by the Anglo-American Brush Corporation, so that there is every guarantee that the idea will be brought to a successful issue.

Lord Thurlow's Bill.

Lord Thurlow's bill to amend the Electric Lighting Act of 1882 is now in the committee stage in the House of Commons, and as it has already passed the House of Lords, it stands a fair chance of becoming a law before the end of the present session. So far its progress through the House of Commons has been almost devoid of incident. On the last occasion of its coming before the committee Sir George Campbell moved an amendment to the effect that when a license has been granted to any company or person for the lighting of a particular area, this should not prevent another license being issued to some one else for the same area. This amendment was opposed on the part of the government, as being utterly inconsistent with the whole scope and intention of the bill. Sir George Campbell declined to withdraw his amendment, however, and the time of the committee was wasted until the period of adjournment arrived.

THE TELEGRAPH.

Western Union Earnings.—The net revenues for the June quarter are placed at $1,350,000, and a dividend of 1¼ per cent. has been declared. It is estimated that the net receipts for the next quarter will reach $1,600,000. The gross receipts of the present quarter will be the largest on record by the company, exceeding $5,000,000.

Western Union, Boston.—The Boston *Herald* of June 10 contains a very interesting article on the Western Union office in that city. The operating force now numbers 110 persons, and about 18,000 messages daily are handled. The total number of employés in the office is about 300, and there are about 200 linemen and others. The main office takes in about $40,000 a month. There are also 33 branch offices.

THE TELEPHONE.

Willimantic, Conn., is going in extensively for long distance telephone service.

Holyoke, Mass.—The paper mills at Holyoke have adopted the long-distance telephone system.

St. Louis, Mo.—A special dispatch from St. Louis of June 14 says: The trouble between the city authorities and the Bell Telephone Company has been temporarily compromised. At a meeting of the Citizen's Committee, Mayor Francis, and dignitaries, the telephone company submitted a proposition to replace all the telephones taken out and charge a rental of $50, complying with the ordinance until the validity of the ordinance is tested before the Supreme Court, a case being now on hand which will be forced to a rapid conclusion. In the event of a decision in favor of the Bell Company, the renters of 'phones will pay at the former rate of $100 per year, but the company does not say what it will do in case the decision is against it.

THE ELECTRIC LIGHT.

Pierre, Dak.—The city council is discussing electric lights.

Canton, O.—The Canton Electric Light Company is to erect a new plant.

The Charleston, Mass., Navy Yard is to have an Edison installation.

Albany, Ga.—The Albany Oil and Refining Company is putting in an Edison plant.

Huntsville, Ala.—Mr. W. C. Harris, Jr., will put in a Waterhouse arc machine at the cave of Mr. Fuller.

Santa Clara, Cal.—The Electrical Improvement Company of San Francisco has a ten years franchise for Santa Clara.

Lincoln, Neb.—The Tecumseh Electric Light Company of Lincoln, formed by A. M. Applegate and others, has a capital stock of $25,000.

Memphis, Tenn.—Electric lighting will be discontinued in Memphis during June, July, August and September, on account of a short appropriation.

Colfax, W. T.—The Colfax Electric Light Company has been formed with a capital stock of $12,000. Mr. J. H. Perkins is president and Mr. C. B. Hopkins secretary.

Salem, Ore.—A fire which occurred on June 7 at the Holman Agricultural Works was communicated to the city electric light plant adjoining. The plant was destroyed, with a loss of $14,000.

Newton, Mass., now talks of using electricity exclusively for street lighting, at an expense of $27,000, by the Newton Electric Light Company, and there is talk of the city operating a plant of its own.

Orangeburg, S. C.—Mr. G. H. Cornelson, who is lighting his yarn mill by electricity, is negotiating to put in an extra 20 or 30-light dynamo for city lighting, and it seems likely that the plan will be carried out.

Mount Vernon, N. Y.—The incorporation has recently been made of the Mount Vernon Electric Company by E. S. Sears, H. J. Goff, J. C. Hatch, C. J. Smith and S. J. Stilwell with a capital stock of $50,000.

St. Stephen, Me.—The St. Stephen (Me.) Electric Light Company has taken the initiatory steps to introduce the light in St. Stephen and Calais. It is thought that the system will be in operation early in September.

Greenport City, L. I.—Hyer & Montgomery have closed a contract for a plant of 225 lights of 30 c. p., Heisler system, for the Greenport Electric Light and Power Company. The lights will be placed on the streets as well as in stores and residences.

Warning Flashes.—It has been stated in the New York Aqueduct investigation that warnings of the approach of the engineers was given to the contractors and their men by flashing the arc lights, and hence things were always "fixed" in readiness to deceive.

Virginia Beach, Va.—The Princess Anne Hotel, at Virginia Beach, has a fine Brush plant, comprising three dynamos, which run 350 incandescent and 15 arc lights. A Ball engine drives the dynamos. The plant was installed by Mr. A. Henderson, and Mr. Parmlee is in charge.

Fall River, Mass.—The Fall River (Mass.) Electric Light Company has purchased the land next south of the site occupied by the Edison Company, on Hartwell street, and will erect a commodious station capable of supplying the requirements of the business for many years.

Staten Island.—Upon the application of the Staten Island Telephone Company, Judge Andrews of the Supreme Court has granted an injunction restraining the Richmond Light, Heat and Power Company from interfering with the posts, wires or right of way of the plaintiff company.

Newport, R. I.—At Newport, R. I., on June 5, the City council voted to renew its contracts for street lighting with the present contractors at a uniform reduction of ten per cent. from present prices. The contracts include electric, gas and naphtha lamps, and the new contracts will save the city several thousand dollars.

Lockport, N. Y.—The office and laboratory of Cowles' Electric Aluminum Works, in Lockport, N. Y., in the building detached from the smelting works, were burned Wednesday night, June 13. The building burned with such rapidity that nothing was saved. The loss is between $3,000 and $4,000; insurance, $2,000.

Nantucket, Mass.—A correspondent writes to the *Manufacturers' Gazette* that a project is on foot to establish an electric light plant in Nantucket for the summer months. It is proposed to extend the wires to such sections of the town, particularly Brand Point and Cliff, as are not reached by the gas mains, and also to run a line to Siasconset.

Schuyler Plants.—The Schuyler Electric Company, of Middletown, Conn, reports business as being exceedingly good and factory running nights to keep up with orders. Among the new plants recently contracted for are Great Barrington, Conn., 25 arc lights; Millersburg, Ohio, 35 arc and 100 incandescent; and Mt. Vernon, O., 74 double arc lamps for all night lighting.

Waterhouse Plants.—Mr. W. N. Gray, who is the representative of the Waterhouse system in Cincinnati, has placed a 30-light plant in the famous picnic ground there known as the "Coney Island of the West." He has also sold a plant to the Ohio Penitentiary, at Columbus, to be used principally for lighting the space just inside the walls to assist the guard in preventing escape. Mr. Gray is one of the commissioners of the Ohio Centennial Exposition.

Hackettstown, N. J.—The Heisler system has been adopted at Hackettstown, N. J., for street and commercial lighting, and a plant erected by Messrs. White & Rusling, agents for the company, of 137 Broadway, N. Y. The contract was signed and the order sent for the electrical appliances May 1, and the apparatus was tested and the lights turned on for the first time on the 2d of June. This is putting up a plant on pretty short notice.

The Mather System.—The Woman's Reformatory Prison at Sherborn, Mass., is to have an electric light plant, and the contract has been awarded to Messrs. Claflin & Kimball, New England agents for the Mather Electric Company, for 320 incandescent lights, and they will begin work on the plant at once. This makes the second State institution lighted by electricity, the other being the State almshouse, Tewksbury, Mass., of 500 lights, which was also awarded to the Mather Company, and has proved highly satisfactory.

Fitchburg Engines.—The Fitchburg, Mass., Steam Engine Company reports business very good at present, it having on its books orders for engines to go to Ansonia, Conn., 90 h. p. Also 50 h. p. engines for Brattleboro, Vt.; Spring Forge, Pa.; Danville, N. Y.; 250 h. p. for Lynn, Mass.; 900 h. p. for Ohio. It is fitting out many electric light stations throughout the country with complete plant. Among others it has engines building for Gardner, Mass.; Norwalk, Conn.; Boston, Mass.; Bristol, Tenn.; Malden, Mass.; Mechanicsville, N. Y., etc. It has just started a 200 h. p. for the Mount Morris Electric Light Company, Harlem, N. Y.

APPLICATIONS OF POWER.

The Electric Storage Battery Company, of Glouscester City, N. J., has been incorporated by W. Shapleigh and others.

Electric Fare Boxes.—The Sprague road now building at Davenport, Ia., will have Crowdus electric fare boxes on all its cars.

The American Electric Motor Company, of Jersey City, has been incorporated by J. H. Lippincott and others, with a capital stock of $1,000,000.

Salem, Mass.—The Naumkeag street railway of Salem will apply the Sprague electric motor to six cars. There is a great belief that electricity may yet be used instead of cables in Boston. —*Boston Herald.*

Lima, O.—The Lima Street Motor and Power Company has purchased a 100 horse-power Silvey generator to add to its plant, which now has a 60 horse-power. It will also have a 15 horse-power Silvey street car motor.

An Electric Yacht is now being built at Newburgh, N. Y., by the Messrs. Bigler for the Electrical Accumulator Company, to be run by storage. She will be 38 feet long and 9 feet breadth of beam. She will have a cabin in the middle, and the storage batteries will be placed in tiers along the sides.

New York City.—It is not improbable that the Broadway and Seventh Avenue Surface Railway Company may before long replace the present system of horse-power with electricity. Thomas F. Ryan, secretary and treasurer of the Broadway Company, said last week that it would like to get rid of horses and substitute electricity if it were proved a cheaper motive power.

Motors for Men-of-War.—The Sprague Electric Railway and Motor Car Company have received an order from the U. S. Government for motors for use in the service, and an installation is to be made at once on board the U. S. steel cruiser "Chicago" of motors to be used in the training and elevation of the guns. The electrical and mechanical apparatus required for this work will have to be of the most delicate and perfect construction.

No Power Better than the Electric.—Of the many instances we see every day of the superiority in the economy, reliability and cost of maintenance of electric power, one of the most striking is the experience of Mr. L. J. Wells, of Des Moines, Iowa, who says: "I have been using a three horse-power Sprague electric motor for nearly three years, running elevator hay hoist, pump, horse cleaners and ventilating fan. It has not cost me one cent for repairs, and saves me at least six hundred dollars a year."

PERSONALS.

Prof. A. E. Dolbear is to speak before the American Institute of Instruction at Newport on July 9 on "Recent Advances in Electrical Science."

Mr. J. Potter, the treasurer of the Brush Electric Company, is in New York in charge of the office here, while Mr. Swift is in Cleveland with his family, which has lately been increased.

Dr. Norvin Green, while traveling by train lately, was called upon to resuscitate a passenger taken suddenly ill, and showed that he had not lost any of the professional skill which first made him known in the old Kentucky days.

MISCELLANEOUS NOTES.

Dead Wires and Poles.—The Board of Electrical Control is now making a laudable crusade on "dead" wires and "dead" poles.

A Rat Alarm.—Mr. W. Andrews, of St. Louis, has a burglar alarm service. Several false alarms have now been traced to the rats, who have eaten off the insulation of the wires and have made the wires cross.

"Dead Wires."—Mayor Hewitt has requested the Commissioner of Public Works to find out the number of "dead" wires strung on poles in the streets of New York city and to see if steps cannot be taken to compel the electrical companies to remove them.

The De Bausset Air Ship.—A dispatch from Washington of June 13 reports that Representative Landes, of Illinois, from the Committee on Ventilation and Acoustics, has reported a bill appropriating $150,000 to enable A. de Bausset to build an air ship.

The Cincinnati Exposition.—The Cincinnati *Commercial Gazette* devotes three columns, with numerous illustrations, to the special electric lighting effects which have been designed by Mr. W. J. Hamner for the Ohio Centennial Exposition. Electrical performances, including the various *pièces de resistance*, will be given every evening.

The Hebrew Technical Institute, of this city, is doing admirable work, as was shown by the fourth annual exhibition held last week. An electrical department has been added, and one of the pupils has already built a neat little sewing-machine motor.

The Board of Electrical Control has elected as its electrical expert Mr. Schuyler S. Wheeler, who stood at the head of

the civil service list both in the written and in the oral examination. It has also elected inspectors, and taken other steps to render its organization complete and efficient. It proposes to have all lighting plants in the city examined and approved, by July 1, as well as all conductors by July 15.

The Junior Edison Association held its last meeting, by special invitation at Mr. Edison's laboratory at Orange, on June 15, when Mr. A. E. Kennelly delivered a lecture on new methods of finding faults in underground wires. Mr. Edison also made a few remarks on allied topics. The attendance was large and a very pleasant evening was spent.

The Danger of Malt Dust.—Malt dust may make a fire as easily as flour dust has done at Minneapolis. But no dust will make a fire without a struck match or some jet of flame. It really looks as though workers in mills, who are obliged to carry lights about, should take example from the mines, and that the lighting of such buildings by electricity would forestall the use of any matches. Until the University Museum fire shall have been clearly investigated there is no use speculating deeply into causes, but it may be observed that no rats could well gnaw the so-called safety matches so as to produce a flame. The sort of match that "lights" only when struck on the chemically prepared side of the box is nearly as safe as a wet sponge to leave about. If smoking is rigidly prohibited in any building where valuables are stored there is no reason for any other kind of match to be thrown about by workers or visitors.—*Phila. Ledger.*

Storm in Milwaukee.—A special dispatch of June 14 from Milwaukee says: The most severe and damaging electric storm that has occurred in many years struck this city this morning and played general havoc with telegraph and telephone and electric light wires. A telephone cable containing about 300 wires, connecting the west and east sides of the city, was burned off. All telephone service in the city was suspended for a time. Both the police and fire alarm systems were badly damaged, and at the Badger Illuminating Company's building a testing box was knocked out and an employé severely shocked. The pecuniary loss is not very heavy, but the inconvenience of suspended telephone and light service will be felt for several days.

BUSINESS NOTICE.

The Partz Electric Battery Company, of 1,723 Chestnut street, Philadelphia, have three batteries which they make a specialty of, namely, a motor, acid gravity and open circuit. Send for their catalogue. The results of three years' use are simply marvelous.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, red and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

A Big Leather Link Belt.—Chas. L. Ireson, 97 High street, Boston, has just completed one of his patent self-adjusting leather line belts for Seth F. Dawson, leather board manufacturer, Lawrence, Mass., which is undoubtedly the largest leather link belt ever made in the world. It is 76 feet long, 32 inches wide and weighs 780 pounds. It required 106,775 leather links to produce it.

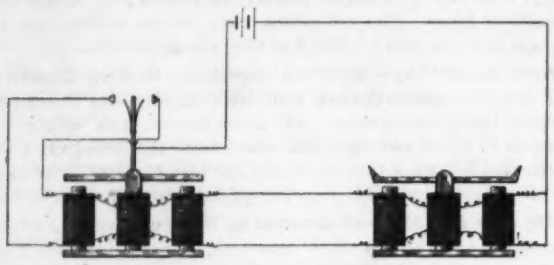
The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them stating what you want.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JUNE 12, 1888.

384,271. Electric Pendulum Clock; Albert L. Parcelle, New York, N. Y., Assignor to the Manhattan Clock Company, of Colorado. Application filed March 23, 1887. A magnet and connections are arranged to vibrate the pendulum without opening the battery circuit.

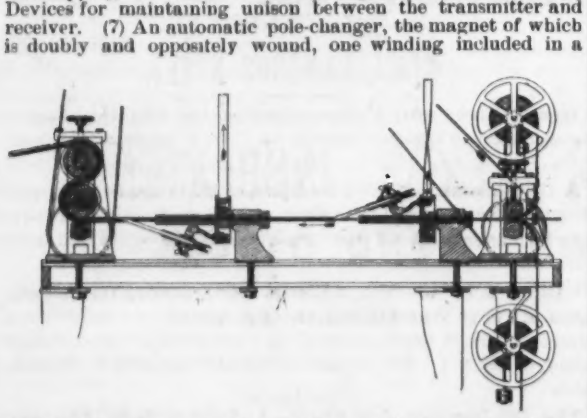
384,280. Automatic Switch for Secondary Batteries; John S. Sellon, Hatton Gardens, County of Middlesex, England, Assignor to the Electrical Accumulator Company, of New York. Application filed Oct. 30, 1887. Patented in England Jan. 13, 1883, No. 217; in France June 20, 1883, No. 156,156, and in Germany July 17, 1883, No. 27,868.



384,326. AUTOMATIC POLE CHANGER.

The invention consists in an arrangement of apparatus for automatically dividing an electrical circuit containing a primary generator and a secondary battery into two electrically-independent circuits, and for again uniting such circuits into one undivided circuit, which operations both follow predetermined changes in the electrical condition of the circuit or circuits. See illustration.

(1) 384,320. (2) 384,321. (3) 384,322. (4) 384,323 (5) 384,324. (6) 384,325 and (7), 384,326. (1 and 3) Printing Telegraphs; (2) Polarized Electro-Magnet; (4) Automatic Pole Changer; (5 and 7) Automatic Telegraphy, and (6) Automatic Pole Changer; Edward J. Mallett, New York, N. Y. Applications filed respectively Feb. 26, 1887; Feb. 17, 1887; Feb. 26, 1887; April 5, 1888; April 5, 1888; April 9, 1888, and April 5, 1888. (1) The invention contemplates the use in the receiving instrument of two type wheels, two press pallets and an independent magnet for each of the pallets, the condition of the line at the time reversals are stopped thereon determining which one of the two magnets shall be called into operation and consequently which type wheel shall be called into operation. (2) The electro-magnets fixed to a common yoke, with an armature pivoted to the core of the middle magnet and adapted to rock from pole to pole of the exterior magnets. The armature is inductively magnetized through its pivotal connection with the pole of the middle magnet, which is maintained in a closed circuit during the operation of the instrument. (3) Two sliding type wheels are arranged in connection with two pallets in such a manner that the position of the wheels depends on the movement of the pallets. (4) See (2). (5) An improvement on the stopping mechanism described in patent No. 343,042. (6) Devices for maintaining unison between the transmitter and receiver. (7) An automatic pole-changer, the magnet of which is doubly and oppositely wound, one winding included in a



384,404. MACHINE FOR COVERING OR INSULATING WIRE.

circuit completed through one of the sets of contacts of the pole-changer, and the other winding included in a circuit in derivation to the one first named, and completed through the other set of contacts of the pole-changer. See illustration.

384,350. Combined Telegraph Key and Sounder; John Doggett, Plain City, Ohio. Assignor of one-half to Leonidas J. King, of same place. Application filed Nov. 30, 1887. A double key, pivoted in the middle and having a button at each end. May be operated from either side.

384,362. Ship's Log; Eugene E Haskell, Forestville, N. Y. Application filed Jan. 17, 1888. The number of revolutions of the ship's log is determined by the number of times an electric circuit is completed.

384,384. Metallic Crest-Tile Lightning-Rod; Clark B. Nelson, Crawfordsville, Ind., Assignor of one-half to James H. Watson, of same place. Application filed Nov. 16, 1887. The ridge pole of a building is made in the form of a toothed plate. It is connected with ground.

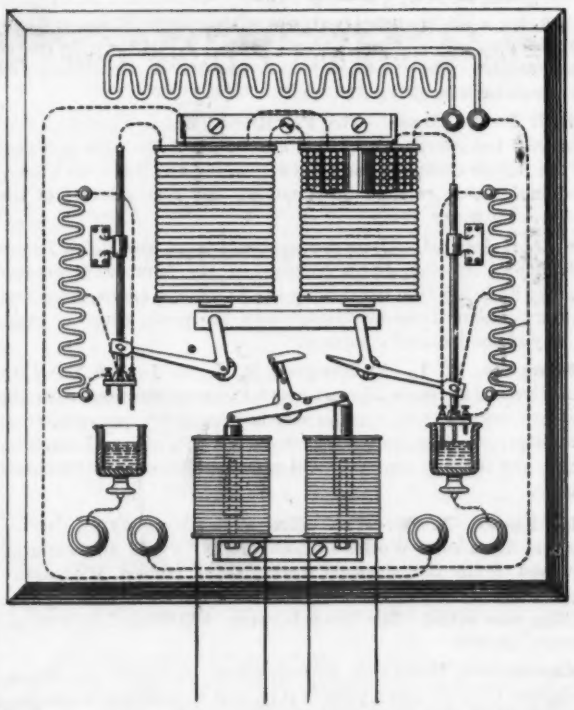
384,404. Machine for Covering or Insulating Wire; Joseph D. Thomas, South Framingham, Mass. Application filed Aug. 20, 1887. A prominent feature of the invention consists in covering wire with two or more successive adherent strips or tapes wound on spirally, the second tape being wound at a reverse inclination to the first, so that the seams of one tape "break joints" with the other tape and lie at nearly right angles to each other, whereby a very strong and impervious covering is produced. See illustration.

384,431. Electrical Annunciator; Hiram S. Downerd, Zanesville, O. Application filed Jan. 28, 1888. Structural details.

384,440. Electric Circuit Controller; Otto F. Greim, Newark, N. J. Application filed Dec. 31, 1887. A modification of the snap switch.

384,447. Regulating Commutator for Secondary Batteries; Edmond Julien, Brussels, Belgium, Assignor to the Julien Electric Co., of New York, N. Y. Application filed Feb. 17, 1886. Patented in Belgium Feb. 15, 1884, No. 64,170; in Germany, Feb. 15, 1886, Nos. 40,623 and 40,641; in England, Feb. 19, 1886, No. 2,470; in Italy, March 20, 1886, No. 66; in France, Nov. 8, 1886, No. 179,109; in Spain, Nov. 27, 1886, No. 10,387; and in Portugal, Dec. 30, 1886, No. 1,110. This is a switch having a series of contacts arranged upon a cylinder and in connection with a set of storage batteries and by means of which the cells can be grouped at will for different work and so that they are all discharged evenly.

384,455. Printing Telegraph Receiver; Henry Mahnken, of New York, N. Y., Assignor to John Arderson, of same



384,289. AUTOMATIC SWITCH FOR SECONDARY BATTERIES.

place. Application filed Nov. 21, 1887. The object is to control two independently rotating type wheels from one source of power and by a single escapement.

384,472. Electric Winding Attachment for Clocks; Andrew J. Reams, Augusta, Kan. Application filed Oct. 29, 1887. A motor is geared to a clock. Its circuit is closed at stated intervals and winds up the clock spring.

(1) 384,476. (2) 384,477. (1) Police Electric Signal System; (2) Multiple Switch-Board Circuit; Charles E. Scribner, Chicago, Ill., Assignor to the Western Electric Company, of same place. Applications filed Dec. 27, 1886. Details.

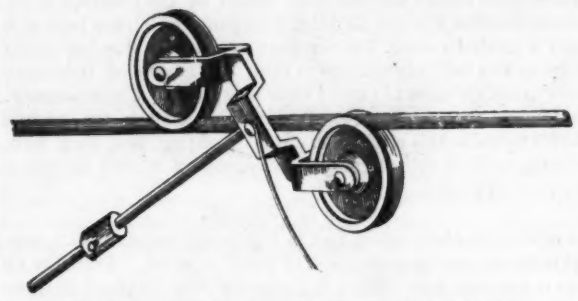
384,478. Incandescent Lamp Socket;; John Spink and Charles Ganzentes, Bradford, County of York, England. Application filed Jan. 26, 1888. The leading-in wires are extended outside beyond the neck of the lamp and are surrounded by a cement of insulating material.

384,505. Car Truck; W. J. Brewer, of London, County of Middlesex, England. Application filed July 26, 1887. An arrangement of anti-friction bearings for the motor.

384,561. Electric Comb; Carl Busch, Chicago, Ill. Application filed Jan. 26, 1888. The back of a metallic comb is hollow, and carries a core of metal surrounded by a sleeve of material charged with an excitant.

384,562. Electric Railway; G. Herbert Condict, of Philadelphia, Pa., Assignor to the Electric Car Company of America, of Pennsylvania. Application filed Jan. 16, 1888. In carrying out the invention there is provided a car or vehicle with suitable guides or supports, preferably under the seats and upon each side of the car. Upon these guides the slide or frame upon which the batteries are supported runs. The car having the spent batteries is brought close to a truck or carriage upon a track substantially at a right angle to the truck-track. The exhausted or spent batteries on their slides or frames are drawn out of the car upon this truck, and after shifting the truck are replaced by others freshly charged. See illustration.

384,570. Electric Circuit Closing Device; Milton W. Grovesteen and Frederick G. Jahn, of New York, N. Y. Application filed Feb. 24, 1888. A fluid, under pressure, in passing through a tube, operates a hinged valve or vane, which communicates motion to an arm extending to the outside of the



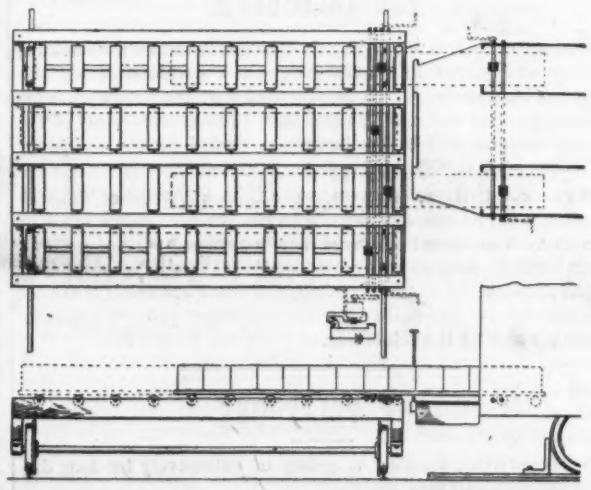
384,594. SYSTEM OF ELECTRIC LOCOMOTION.

tube. The passage of the fluid is not hindered, and the motion of the arm may be utilized in any way.

384,576. Electric Railway; Rudolph M. Hunter, Philadelphia, Pa., Assignor to the Electric Car Company of America. Application filed Oct. 5, 1887. A construction of the car whereby facility in the handling of a battery is secured.

(1) 384,580. (2) 384,581. (1) Apparatus for Electric Traction; (2) Electric Railway Car; Edmond Julien, Brussels, Belgium. Applications filed respectively Feb. 16, 1886, and March 16, 1887. Patented (1) in Belgium, Sept. 7, 1883, No. 62,521; March 7, 1884, No. 62, 421; Feb. 5, 1886, No. 71,868, and Nov. 19, 1886, No. 75,288; and in England, Feb. 19, 1886. No. 2,470. (2) Patented in Belgium, Nov. 19, 1886, No. 75,288. (1) Means for mounting the motor upon the vehicle and also devices for adjusting it thereon. (2) A commutator is arranged beneath the car and is operated from either platform of the same. By the use of it the accummulator may be coupled in any way desirable.

384,594. System of Electric Locomotion; Henry A. Seymour, Washington, D. C., Assignor to the Brush Electric Company, of Cleveland, O. Application filed June 7, 1887. The inventor constructs a truck of contact rollers which, when placed upon the aerial conductor, will cause the rollers to grasp the conductor between them, so as to establish and maintain contact on two opposite surfaces of the conductor, and the arrangement is such that any tendency of the truck to leave the wire or conductor on one side will operate to press it with increased force against the other side of the conductor. In addition to this, contact with the line conductor is maintained at two points a suitable distance apart from each other, so that if by the presence of rust upon the conductor, or for any other reason, there should be an insulating spot at one point in the line, electrical contact will be supplied at another point in the line.



384,562. ELECTRIC RAILWAY.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1886—*can be had for* 25 *cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.*